Statement of The Beef Information Exchange

Mark Armentrout, Chief Operating Officer
AgInfoLink Global, Inc.
Before the Subcommittee on Livestock and Horticulture
Committee on Agriculture
U.S. House of Representatives
The Honorable Robin Hayes, Chairman
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Introduction and Executive Summary

Mr. Chairman and Distinguished Members of the Subcommittee, thank you for the opportunity to participate in this hearing on a national animal identification system, an issue of great concern for both animal agriculture and the public at large. I am Mark Armentrout, Chief Operating Officer of AgInfoLink Global, a founding member of the Beef Information Exchange, also referred to as BIE. I am accompanied today by fellow founder BIE Members from the following companies: MicroBeef Technologies, Ltd., IMI Global, eMerge Interactive, and APEIS Corporation.

Today I would like to outline the purpose and benefits of BIE. The BIE is an industry-driven, private-sector solution that works to fulfill the requirements of a National Animal Identification System (NAIS) and fulfills the needs of both public and private interests. We have come together to use our experience to advance and accelerate a low-cost implementation of the NAIS by creating the BIE and proposing a technical solution that we believe meets the USDA's investigation and surveillance needs as well as producer and privacy concerns.

Safeguarding the health of the national livestock herd and protecting the interests of America's animal producers is vital to the well-being of animal agriculture and all U.S. citizens. As long-time participants in animal agriculture, we recognize that by protecting the agricultural industry, we promote human health; provide wholesome, reliable and secure food resources; mitigate national economic threats; and enhance a sustainable environment. Central to achieving these goals is an efficient and effective animal identification program with 48-hour traceback capability while protecting producer and processor rights by preserving data privacy and data confidentiality on all animals in the national herd that are not involved in an immediate investigation or surveillance activity. Both objectives are equally important.

The need for a national identification program has never been more urgent as U.S. producers have experienced increased market volatility, closed export markets, and perilous trading relationships that have depressed the value of beef by over $165 per head. Livestock producers are united in their commitment to producing the safest and most wholesome food products in the world. Many producers are very concerned over the unknowns associated with the implementation of the NAIS, especially the data privacy issues. They are looking to industry leaders and others to provide education, guidance and valid solutions that protect their livelihood and investments as well as the interests of consumers. The time to move forward with the NAIS is now, and the BIE Member companies all support the NAIS program objectives to provide a 48-hour traceback. Recognizing that there is no perfect alternative for such a system, BIE Members have worked to provide their opinion about what constitutes the best alternative, based on objective criteria. We believe that the best solution is one that meets the following requirements:

- Holds individual animal location and movement data in specially certified private sector companies (which we call "Data Trustees").
- Automatically and electronically provides federal and state government agencies with information on individual animals and individual premises when those are involved in an investigation or surveillance.

The NAIS is the right decision, but it must utilize the best available technology; be based on the most sustainable infrastructure; and be implemented by those who are most experienced within the livestock sector. The system that accomplishes these objectives should be both dynamic and flexible incorporating new and proven technologies as they become available and flexible enough to allow traditional production practices to continue.

Reaction to the BIE concept from farmers and ranchers, producer organizations, state and local health officials, members of Congress, and other data service providers has been overwhelmingly positive. The difference between BIE and other alternatives is that we have proven systems and an established track record. BIE Members have made the necessary investments to develop the systems and infrastructure to accomplish the requirements set before the industry by USDA in the NAIS document and we desire to supply these inventions to USDA and the industry. In some cases Members of this group have had tracking or traceback systems in place for greater than 10 years. Our combined intellectual property, implementation expertise, and existing system infrastructure mean that BIE Members are uniquely qualified to implement a private-sector solution and can do so more quickly, efficiently, and at a lower cost than any other alternative including a centralized public-sector database.

The adoption of commercial management and animal identification systems also provide livestock producers a direct economic benefit by gathering more information on their herd and making management and genetic improvements with the data and the systems. These types of improvements are well documented and provide producers an opportunity that increases the value of their herd in conjunction with improving the health and well-being of the entire agricultural complex.

A critical element regarding the implementation of the NAIS is the extensive effort that will be needed for effective communication and education in order to obtain industry support and participation. This required effort speaks clearly to the opportunity for a government-industry partnership. BIE Members are committed to working with industry associations, USDA, state health departments, land grant universities and others to gain participation in the NAIS undertaking and have an effective jump start on the process with our respective customer bases and existing field forces.

Yesterday, BIE Members conducted a live demonstration of the BIE system for members of the House, their staff, and USDA officials. The demonstration effectively established that competing and dissimilar database systems can be seamlessly linked and that we are currently capable of collecting, storing, and reporting the required data at the speed of commerce to meet the 48-hour traceback objectives. We are confident that the BIE concept is the most efficient, practical, and readily implementable solution for animal agriculture to conform to the requirements of the NAIS.

Mr. Chairman and Members of the Subcommittee, we respectfully submit that the BIE model and infrastructure plan provides the best alternative for the implementation of the NAIS and that it is ready to implement and scale immediately. We recognize that this effort is a significant undertaking and that no one entity can do this alone. BIE serves as a positive example to industry and government, that through collaboration, we can work together to meet and serve the needs of the greater good. We thank you and look forward to answering your questions.

Name: Olin Mark Armentrout

Business Address: 1860 Lefthand Circle, Suite G
Longmont, CO 80501

Home Address: 13185 Bethany Road
Alpharetta, GA 30004

Telephone: 303-692-9898 Business
770-329-5375 Cell

Mark Armentrout is a co-founder and Chief Operating Officer of AgInfoLink Global Inc. AgInfoLink is one of the five founding companies of the Beef Information Exchange. Mr. Armentrout is also co-owner of a custom cattle-feeding business in Oakland, Iowa. He has experience in all phases of beef cattle production and in establishing beef production alliances.

Mr. Armentrout is a past President of the Georgia Cattlemen's Association and past Chairman of the National Cattlemen's Beef Association's Industry Planning Group. He is also past Chairman of the NCBA International Markets Committee, which is responsible for all issues affecting international trade including market access, market development, and trade dispute resolution. Mr. Armentrout has been a member of the Executive Committee of the US Meat Export Federation and was appointed to USDA's Agricultural Technical Advisory Committee for Trade in Animals and Animal Products in 1994 by the Secretary of Agriculture.

Mr. Armentrout has global experience as a consultant working in a wide variety of meat and poultry harvest and further processing plants.

Mr. Armentrout is a native of Virginia and graduated with Honors from the United States Naval Academy in 1973. Mr. Armentrout served his country as a Navy Nuclear Qualified Surface Warfare Officer. On his last tour of active duty service he served as the Auxiliaries Officer on the USS Nimitz, a nuclear powered aircraft carrier, where he was responsible for 135 men and the maintenance and operation of all auxiliary equipment including mission critical hydraulic systems, liquid oxygen and liquid nitrogen distillation plants, air-conditioning, and refrigeration. He and his family reside in Alpharetta, Georgia, a suburb of Atlanta.

1. Executive Summary

The Beef Information Exchange Members are Concerned for the Future of the Beef Industry

The Beef Information Exchange (BIE) Members are five independent companies with over 50 years of experience identifying and tracking millions of individual beef cattle with regard to their ID, health, and growth. BIE Member companies understand what works when tracking beef cattle and want to utilize our knowledge and experience to help the USDA, National ID Development Team, and various producer organizations, producers and processors make animal identification work in the United States.

To us, a workable national identification program is one that meets both the government's need for 48-hour traceback and the private industry's need to preserve data confidentiality and privacy. We believe it is possible to satisfy both goals with a small set of specific enhancements and clarifications to the United States Animal Identification Plan (USAIP). This document summarizes our recommendations.

The Beef Information Exchange and USAIP Designers Have the Same Goals

The BIE Member companies agree that protecting American animal agriculture by safeguarding animal health is vital to the well-being of all U.S. citizens. We recognize that protecting animal agriculture promotes human health; provides wholesome, reliable, and secure food resources; mitigates national economic threats; and enhances a sustainable environment. Essential to achieving this goal is an efficient and effective animal identification program with 48-hour traceback capability. We also support the fact the USAIP is focused on utilizing state-of-the-art national and international animal identification standards with the best available and practical technologies. We agree that the plan should be both dynamic and flexible, and should incorporate new and proven technologies as they become available.

BIE Members strongly support the efforts that have brought the USAIP document to its current state. We appreciate the fact that more than 100 animal industry and state and federal government professionals representing more than 70 allied associations and organizations collectively worked together to create the current document. BIE Members, many who participated in drafting the plan, have spent substantial time assessing the draft plan in order to suggest additional improvements and enhancements. Our goal has been to ensure the final plan meets current and future U. S. animal identification needs for both the government and private industry. We believe these recommendations, if incorporated into the plan, will help build on the strong foundation the National ID Development Team has created, and help make the plan a success.

We acknowledge that costs associated with the USAIP will be substantial and that public or private funding is justified. Significant state and federal costs will be incurred in overseeing, maintaining, updating and improving necessary infrastructure. Continued efforts will be required to seek federal and state financial support for this system to protect American animal agriculture. With these factors in mind, BIE Members suggest that implementing these recommendations allow better coordination between existing private systems and government systems will allow a more rapid implementation of the USAIP at the lowest possible cost.

Towards all these ends, the BIE Member companies respectfully make the following recommendations for clarifications and enhancements to the USAIP document. BIE Member companies believe that these clarifications and enhancements taken in the context of the entire USAIP document are relatively minor and can be incorporated without changing the USAIP system goals.

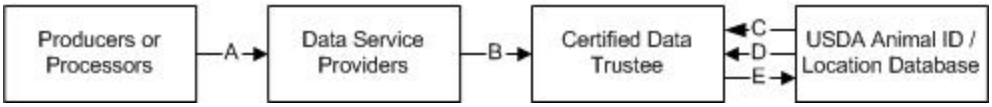
Beef Information Exchange Member Recommended Improvements

System clarifications and enhancements recommended by BIE Members can be categorized into four major areas: data architecture; numbering system; reporting and receiving procedures; and improved data management practices. Implementing these changes involves relatively minor changes to the overall plan. All recommended changes are supplemented with technical papers that may be found in an appendix for each respective topic.

Data Architecture

BIE Members recommend that a new role of Data Trustee be implemented between Data Service Providers, livestock markets, packers, and the USDA (see Figure 1). The Data Trustee will hold actual identification and premises data for each animal and provide the USDA central database only the animal's identification number and the name of the Data Trustee holding the data. By connecting these Data Trustees to the USDA system via high-speed internet connections, data can be rapidly provided to facilitate 48-hour traceback in the event of an animal incident. Traceback would be initiated by USDA asking the Data Trustee of a target animal for its identification and premises information along with any cohort information. USDA would then obtain information from other Data Trustees who have information on specifically-identified animals. Typically, this investigation will result in information on only a small percentage of the national herd being transferred to the USDA.

Figure 1. "Pull" Database Architecture



The benefit of this approach is that confidential data would not be visible to government agencies, helping to protect the security of the private industry. BIE Members anticipate there will be multiple Data Trustees, approved by the USDA and certified and audited by industry associations. This data architecture is one that has worked extremely well for the global credit card system and other large-scale, distributed databases. Furthermore, this is consistent with the USAIP document's statement on page nine that the USAIP system may be implemented as a series of seamlessly-linked databases.

Numbering System

The existing plan calls for the official animal number to be the same number as that of an RFID device. Because a physical device is not permanent, it may become lost or unreadable. The BIE Member recommendation would accommodate the existing USAIP plan of having the number encoded into the first RFID device be the same as the official animal number. The BIE Members refer to this number as the UAIN or Universal Animal Identification Number.

The Numbering System (See Figure 2) for individual animals recommended by BIE provides for:

1. Permanent use of a unique permanent database Universal Animal Identification Number (UAIN) to which all ID devices and methods are permanently linked in the database.
2. Permanent allowed use of existing ID devices and methods linked to the database UAIN.
3. Permanent requirement for an Official Device Animal Identification Number (DAIN), to be linked to the database UAIN.
4. Transitional requirement of either an official RFID (DAINRF) or official Visual device (DAINVI) to be linked to the UAIN.
5. Post-transitional requirement for only the DAINRF to be used with optional DAINVI.
6. Permanent use of any ISO-Compliant RFID tag allowed as a DAINRF with the knowledge that through normal attrition all will be replaced with 840-country code single or multi-use RFID tags (DAINRF).
7. Permanent use of existing visual device number systems on the DAINVI tag which contains an Official ID number

Figure 2. Identification Systems.

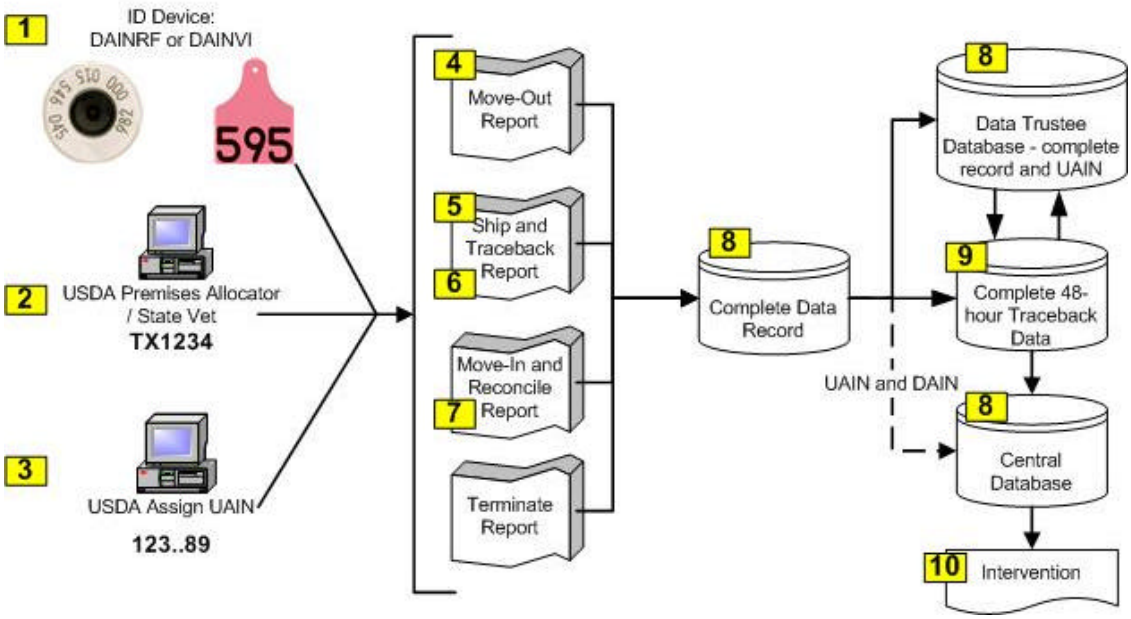
A. Database Numbers	Classification	Official/Allocated
1.Premise Number in Database	Unique/Permanent	Yes
2.Non Producer Participant Number in Database	Unique/Permanent	Yes
3.Individual Animal Number In Database UAIN	Unique/Permanent	Yes
B. Physical Device or Method (one or more linked to UAIN)		
1.Official DAINRF Any ISO	Unique	Yes
2.Official DAINVI	Unique	Yes
3.Alternate Visual Device	May be Unique	No
4.Alternate Retinal Scan	Unique	No
5.Alternate DNA Profile	Unique	No
6.Alternate Brand/Markings	State Unique	State
7.Alternate Other	May be Unique	No
C. Group / Lot ID	Unique	Yes

Reporting and Receiving Procedures

Include movement reconciliation as part of the process, specify how marketing traceback data are to be used and ensure confidentiality of Premises IDs.

The existing document makes no mention of a number of features BIE Members believe are important to effective operation of the overall system. To elaborate on what BIE Members believe is the intention of the USAIP, we propose that the overall reporting and receiving procedures include the data flow seen in Figures 3 and 4. It is important to note that our recommendations are similar to the flow shown in the USAIP document. These recommendations add the ability to achieve a higher level of efficiency and integrity to the recording and traceback process without compromising the USAIP intent.

Figure 3. BIE-Recommended USAIP / Traceback System



Specific key improvements and highlights are as follows (see Figure 3):

1) Unrestricted availability of official and alternate identification devices and tagging animals for identification when it is most convenient for the producer's management practices

2) Data Trustees (DT) check for allocated valid Premises ID of both the Source and Destination.

3) Allocated UAIN animal assignment by UAIN numbered DAIN or other official numbered DAIN on animal, both linked to UAIN in database by Event Report.

4) Source Move-Out Report to DT for linking of UAIN to DAIN and alternate ID

5) DT provides the Move Out Report to the Source and Destination, including a Traceback record.

6) The DT Premises ID confirmation is used in place of the actual Premises ID number to validate the Premises and protect confidentiality.

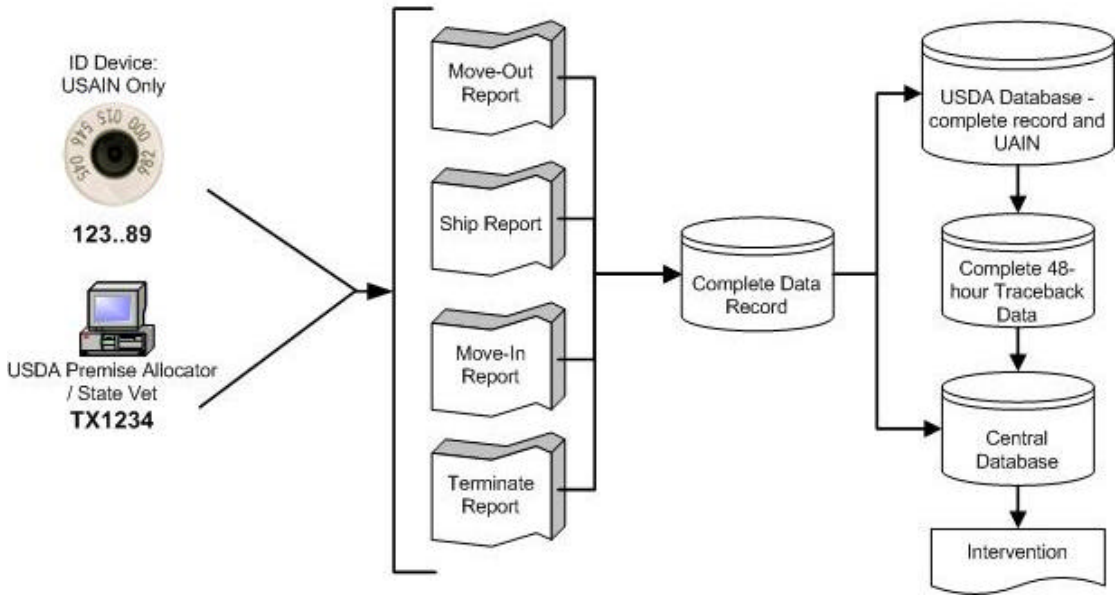
7) Move In Report to DT by Destination and Reconciled by automated process.

8) Immediate transfer of data to the DT Database and the Central Database.

9) Immediate availability of complete traceback data by the government in a foreign animal disease case by pulling data from the DT database as described in Section 2.1 of our comments.

10) Intervention strategy implementation

Figure 4. USAIP Identification / Traceback System



Improved Data Management Practices

BIE Member recommendations address a number of data system operations and functional improvements. Some of these improvements include protecting premises IDs, increasing database efficiency and accuracy, and protecting premises data from FOIA.

The Role of BIE Members Going Forward

BIE Members currently deal day-to-day with beef cattle producers and processors, and we understand their needs and fears. Prior to the implementation, BIE Members would like to use their experience to assist the National Identification Development Team and the Bovine Working Group in designing the best plan possible. No matter how good the initial plan is, new challenges will inevitably arise. From the outset, the BIE and its member companies can use their existing relationships with customers to help overcome implementation issues and ensure that what is actually built and operated is acceptable to the needs and requirements of a diverse industry. BIE and its member companies will provide a vital link between government and industry speeding up the implementation, efficiency, and effectiveness of the USAIP.

Finally, in light of recent developments, many concerned members of the beef industry, for their own protection, want to implement a traceback system provided by the private sector as soon as possible. Among their top concerns are the system costs and assurance that they can continue to use or adopt proven, existing identification and traceback systems, and get started now, while the USDA develops its action steps. The proposed improvements to the USAIP document submitted by the BIE Members will improve the speed at which this goal can be accomplished. Additionally, BIE Members can help reduce the cost of implementing a national identification system by utilizing existing commercial production systems which produce tangible financial benefits to help offset the costs to producers and processors.

2. USAIP Recommendations

BIE members have recommended a variety of improvements to the USAIP document. These recommendations are designed to promote greater user acceptance of the system, to enhance privacy and system robustness, and to improve system effectiveness and flexibility. The details for each of these recommendations are presented below.

2.1 Utilize Privacy-Protected Data Trustees and Use IDs in a Central Database With a Pull for Traceback

What Exists in the USAIP Document:	The USAIP document indicates on page 9 that to achieve the "48-hour" traceback, information on individual animal movement or "units of animals" must be reported to either a central database or "a seamlessly linked local database infrastructure".
What is Proposed:	**We recommend that the USAIP system be composed of "a seamlessly linked local database infrastructure" rather than the single, central database.**
Reference for More Information:	Appendix B – Push/Pull Appendix C – Premises System

Rationale – Improve System Efficiency, Privacy and Acceptance:

Though the USAIP document on page 9 indicates that the USAIP system could be implemented either as a single centralized database, or a series of seamlessly-linked local databases, the remaining sections of the USAIP document create the presumption that a single, centralized database will be used, especially the diagrams in section IV beginning on page 21.

Push Architecture:

Utilizing a single, centralized database will be difficult because implicit in a single, centralized database system is the notion that data are immediately pushed to that centralized site and that anyone with authorized access to that centralized site has visibility on all stored data. This type of database architecture is commonly referred to as a "push" database system because information is immediately pushed to the single, government site. Figure 2.1 below depicts the "push" approach as illustrated on page 21 of the USAIP document.

Figure 2.1 "Push" Database Architecture

There are a number of concerns centered around a "push" database approach for animal identification because this database architecture routinely stores ownership, movement and location information about individual animals or groups of animals on government databases before that information is required to deal with a specific, valid animal health issue. The Beef Industry has expressed serious concerns about this information being available to government officials and others with no need to control a disease outbreak before it occurs. Based upon this information the BIE believes animal ownership and location information should be made available when needed to facilitate the specific 48-hour traceback requirements.

The "push" approach is not necessary because there is a valid, viable alternative, which will better protect producer and processor privacy while still meeting the USAIP's central objective of 48-hour traceback. That alternative is alluded to in the introduction of the USAIP document on page 9 ("seamlessly linked local databases"), but is not further developed in the document. Before reviewing this alternative, known as "pull" database architecture, we will discuss a few of our concerns about the "push" approach that is currently discussed at length in the USAIP document:

Data Mining Concern: Free government access to location and ownership data in advance of a legitimate animal health emergency need will make user acceptance of the USAIP system very difficult. Even with assurances that these data will be used properly, there will be a strong temptation by various government agencies to explore the data to answer policy or compliance questions that were beyond the scope of the USAIP project. The USAIP is solely designed to rapidly respond to animal disease threats in a 48-hour period, thus no additional use of this ownership and location data should be made. The best way to ensure this occurs is to not have central storage of all data in a government database.

Privacy Concern: Beyond the concern about government agencies potentially data mining information that has been pushed to the government system, there is a strong privacy concern. Given that premises identification numbers, as described in the USAIP document, will quickly become associated with individual producers or processors, commercial data related to ownership and location transactions can be quickly identified. Identifying commercial chain of ownership is clearly an undesirable, unintended consequence of a central database. Overlaid with concerns about having these data potentially discoverable through a Freedom of Information Act request further jeopardizes commercial relationships and USAIP adoption.

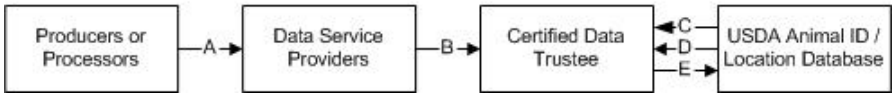
48-Hour Response: Given the discussion above, BIE fully understand that it is valid for the U.S. government and animal health specialists to be able to rapidly perform traceback for animals under question as well as determine the traceback status of any co-located animal within 48 hours.

A 48-hour traceback requirement, though, does not necessitate having the location and ownership data "pushed" into a single, central database. A "pull" database strategy can equally meet or exceed the 48 hour service performance requirement, and can also address the privacy and data mining concerns raised above.

Pull Architecture:

In a "pull" database architecture, each data service provider into which data was input would immediately transfer their data not to a single, centralized government database, but to a Data Trustee. The Data Trustee would be a third-party intermediary between the data service providers and the government database and would act like an escrow agent, holding the producer or processor's data until a legitimate need for that data was established by an appropriate regulatory entity. Figure 2.2 below depicts the basic "pull" architecture.

Figure 2.2 "Pull" Database Architecture



In the "pull" architecture, the data would be pushed from the producer or processor to their selected data service provider (A), and the data service provider would push the data to their selected Data Trustee (B). The Data Trustee would then send only the UAIN (USAIN) of each animal or group to the central, government database (C) along with the Data Trustee's Internet address of where the data are located. When a traceback requirement arose, the government database would ask for the location and ownership information of a specific animal or group of animals and any cohort data (D), and the Data Trustee would automatically provide that information (E).

Data Trustee Role: We anticipate there would be multiple Data Trustees, and these Trustees would be certified and audited by the government or the government's appointed agency (e.g., a species association). The Data Trustee would notify the government central database of the USAIN of each animal received and the address of the location of the specific data. No other actual data would move from the Data Trustee to the central government database until data were requested about an animal or groups of animals, and this request was associated with the established criteria. Producers and processors would be free to choose which Data Trustee they wished to collect and store their data with.

Under this recommendation, the government would still have a single, central database. However, that database would only store the USAIN and the Internet address of the Data Trustee where the data were stored. By knowing only the USAIN, the government would know the number of animals stored in Data Trustee databases, and the government could perform tests of the system to determine that each Data Trustee was performing their obligations.

"Pull" Works: The BIE knows that this "pull" architecture works because it has been used successfully in the past. This is the data approach used for the global credit card systems and credit card transactions are able to occur in a matter of seconds even though the transaction seamlessly links a large number of separate databases. The Animal Health Institute, an association of Pharmaceutical companies for their Electronic Data Interchange (EDI) to obtain product sales information, has utilized a similar method for years.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.1-A
Existing Page & Text:	Page 21 – Illustration IV.1
Recommended New Text:	On the arrow carrying information from 10, 11, and 12 to the National Animal ID Database, add an intermediary database labeled Data Trustees.

Ref Number:	2.1-B
Existing Page & Text:	Page 24, Illustration IV.4
Recommended New Text:	Modify this illustration as described in 2.1-A above.

Ref Number:	2.1-C
Existing Page & Text:	Page 24 – "Brief Animal Event/Transaction Record Flow Chart"
Recommended New Text:	Modify the description such that on steps 10, 11 and 12, the data are shown to flow first to a Data Trustee as opposed to immediately populating the National Animal ID database.

Ref Number:	2.1-D
Existing Page & Text:	Page 24 – No existing text
Recommended New Text:	Add new section IV.B.1 to describe the data flow procedure for the Data Trustee. Add the illustration for the "pull" architecture shown above and in Appendix B immediately after Illustration IV.4.

2.2 Add Traceback Integrity to Animal Identification and Chain of Custody

2.2.1 Use the Universal Animal Identification Number (UAIN) with Multiple Unique Devices

What Exists in the USAIP Document:	The USAIP document proposes that for individual animal identification, the official US Animal Identification Number (USAIN) is the only number to be allowed to be coded into a single RFID device or printed on a visual tag.
What is Proposed:	**We recommend that for individual animal identification, the UAIN (USAIN), be permanently used in the database to be linked to multiple unique physical device numbers as they are recorded for the animal.** **The current USAIP document plan of coding the USAIN into the initial primary RFID tag identifier is not affected by this recommendation provided that this approach is made optional rather than mandatory.**
Reference for More Information:	Appendix D – Alternate Animal ID Appendix E – Universal Animal ID Numbers Appendix F – UAIN White Paper Supplement Appendix G – DAINVI to Complement UAIN Appendix H - DAIN/UAIN Cross-Reference Database

Rationale – Improve System Flexibility, Effectiveness, Robustness and Utilize Proven Systems:

The USAIP document indicates that for the purpose of individual animal identification, the government will issue a U.S. Animal Identification Number - USAIN (page 15), and that this number will be unique. The BIE supports this recommendation as well as the methodology proposed in the USAIP document for issuing the USAIN for each animal in the database and optionally for the identical number on a physical device.

The USAIP document further states that only the USAIN will be coded into a single RFID device or printed on a visual tag and the USAIN will be permanently paired with a specific RFID device or visual tag (pages 15, 17, 19, 23-24, 29, 31, 43-45). A number of problems arise when a single, official USAIN number in a database is also required to be present in a specific, physical identification device on an animal. These issues are described below:

Tags are not tattoos: Except for biometric identifiers and tattoos, no physical identification device is permanent. An RFID tag is not permanent, nor is a visual tag. RFID tags are lost in some percentage of the animals. Visual tags typically are lost at a higher rate than RFID tags because they dangle below the ear and can get more easily caught in trees, brush, or fence. Further, because RFID tags are an electronic device, some percentage malfunction and cannot be read. All of these well-established facts argue against requiring the initial, single government identifier to be in place the animal's entire life. It is simply not a realistic expectation. The USAIP must be designed to easily handle a substantial number of animals which will need re-identification with a subsequent device linked to the UAIN.

Re-establishing identity: If an animal loses its RFID device or visual tag, or the RFID device malfunctions, a new identifier must be attached to the animal. If the RFID tag is to store only the USAIN as defined in the current USAIP document, then somehow the old USAIN must be coded into a new RFID. This process is simply not practical because of the re-manufacturing and delivery time required. Alternatively a new RFID with a different USAIN needs to be inserted in the animal's ear.

With approximately 100 million head of cattle in the U.S., it can be expected that several million head per year will require replacement devices each year. Although databases can associate a single animal with multiple primary keys (the USAIN), this approach is not ideal and introduces technical complexity and potential uncertainty to future traceback and traceforward activities because the USAIN is not permanent.

UAIN - Unique permanent identification number in a database for each animal: A much simpler approach is to have a unique, permanent identification number for each animal – in technical terms, a single primary database key. This number would be the government-issued USAIN which would be a unique and permanent database number for a single animal, linked with the current physical device identifier on the animal (whether visual tag or RFID) and multiple other alternate identifiers. The BIE refers to this official number as the UAIN (Universal Animal Identification Number). When the animal is first tagged, it is possible the UAIN will be no different from the device number as defined in the current USAIP document. In fact, if a manufacturer chose to code the UAIN onto the first physical identifier as described in the current USAIP document, they could do that. However, the producer must be able to link any unique ISO-compliant RFID or visual tag number (DAIN) with the UAIN to be flexible, practical, and workable under actual beef production conditions.

Establishing a unique, permanent database number for the animal, the UAIN, will allow easy re-tagging or re-identification. Under the proposed recommendation, retagging links a new physical identifier with the UAIN. There would not be a change in UAIN for the same animal. There would only be one UAIN, the original UAIN (or USAIN), linked with one animal. Multiple physical identifiers on a single animal can then be easily linked with that single UAIN in the database.

***USAIN Management Unchanged*:** Management of the USAIN (or UAIN) in the database would not change under this recommendation. In fact, the process would be simplified because no physical ID device would need to be allocated in advance to inventory or managed by the producer. The government would allocate the UAIN number to the USAIN Managers as proposed in the USAIP. At the time of tagging, a physical device is obtained, attached to the animal, and linked with the UAIN in the database.

Lookup is improved with the proposed recommendation. When the producer replaces a device (DAIN) on the animal the UAIN database record for that animal is unchanged and it is linked to the new DAIN and the old one retired, thus the system is less complex. Also, anytime a unique physical device number is entered into the computer to review a record, the unchanged UAIN is reported because it is linked directly to the current device number on the animal.

Additional reasons for adopting this recommendation are listed in Appendix E.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.2.1-A
Existing Page & Text:	Pages 15, 17, 19, 23-24, 29, 31, 43-45
Recommended New Text:	Replace the single words or phrases in the above pages with the words as shown in Appendix E.

Ref Number:	2.2.1-B
Existing Page & Text:	No existing Text
Recommended New Text:	Add a new appendix to the USAIP document to describe the cross reference table between the UAIN and the various physical identification devices (DAIN – Device Animal Identification Number) as described in Appendix H.

2.2.2 Permanently Expand the Number of Usable Identification Devices

What Exists in the USAIP Document:	The USAIP document lists only two alternate animal identification types and indicates that alternate animal identification is a temporary stop-gap to handle the transition to full national identification.
What is Proposed:	**We recommend that alternate identification types should be a permanent feature of the USAIP and that more than two alternate identification types should be accommodated.**
Reference for More Information:	Appendix D – Alternate Animal ID Appendix E – Universal Animal ID Numbers Appendix F – UAIN White Paper Supplement Appendix G – DAINVI to Compliment UAIN Appendix H – DAIN/UAIN Cross-Reference Database

On page 56 of the USAIP document, alternate animal identification is limited to two alternate identifications, and it is stated that these alternate ID fields will be phased out in the future. We recommend both statements be amended such that the alternate identification devices will be a permanent part of the USAIP, and that multiple alternate identification devices could be cross-referenced to the official, government animal identification number (USAIN).

The primary limitations of the proposed Alternate Animal ID description in the USAIP document are:

- Data fields are hard-coded into the system and therefore inflexible and restrictive.
- The current format does not allow for additional, alternative, or future ID Types (i.e.: Bar Code, DNA String, Optic Scanned Images, etc.).
- The current format only allows two spaces for Alternate IDs (animals typically have multiple management identifiers or tags).
- Does not provide for existing production identification methods.
- Current USAIN and all Alternate ID types are device-dependent (a tag is not a tattoo, it can be lost or unreadable).

Re-establishing identity when tags are lost or unreadable: One objective of alternate identification devices is to re-establish the identity of an animal, which has a lost, or unreadable primary identification device. In a given herd of animals, for example, some number will have lost their RFID tag during their lifetime. When animals arrive at the pens prior to shipping, the owner needs an easy way to re-establish the correct identity of all animals that have lost their RFID. If the RFID is linked in the database to a management visual tag, for example, which is still in place, then it is easy for the owner to quickly put a new RFID tag in the animal and replace the missing RFID tag number with the new RFID tag number. If there is a Bangs tag still on the animal, re-identification is likewise easy. The same goes with retinal scan images, tattoos or any other form of alternative identification. Therefore, having as many different identification methods for an animal as possible will facilitate re-identification in the event the primary RFID is lost or unreadable. Being able to easily re-identify an animal that has lost its primary identification device will make the USAIP more acceptable to all producers.

Many alternate identifiers are needed: The number of alternative identification types should not be limited to just two. Registered heifers today in many states will generate at least four separate IDs (ISO RFID, Bangs tag number, registered tattoo number, and management visual ID number). It is recommended that a fixed number not even be used. Rather, a data element can be added for the fixed record format that indicates the number of alternate IDs in a given record, and the receiving software can easily and immediately process the resulting variable length, fixed record.

Alternate IDs are linked with USAIN: Having a number of alternate identification methods which are linked in the national database with the USAIN is not a technical challenge given modern database architectures and has been successfully used for many years. In fact, having multiple, alternate identification methods adds robustness and flexibility to the USAIP system.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.2.2-A
Existing Page & Text:	Page 54 – No existing text
Recommended New Text:	Add a new data element between data element 14 (Status) and 15 (Alternate Animal ID 1). This new data element will be called "Number of Alternate IDs". This field would determine the number of paired ID and ID-types would follow.

Ref Number:	2.2.2-B
Existing Page & Text:	Page 54 – Alternate ID Type has a record size of "1".
Recommended New Text:	Change the length of the ID Type from "1" to "3" to accommodate multiple new ID types and to make the ID type more intuitive when raw data are reviewed.

Ref Number:	2.2.2-C
Existing Page & Text:	Page 54 – Alternate Animal ID has a record size of "17"
Recommended New Text:	Change the record size from "17" to "32" to accommodate the alternate ID length of identifiers such as retinal scan data and Microsoft GUIDs.

Ref Number:	2.2.2-D
Existing Page & Text:	Page 56 where it shows that alternate ID will be phased out.
Recommended New Text:	Change the text to indicate that alternate ID will be a permanent part of the USAIP to allow for retagging

2.2.3 Create Two Official Identification Device Fields DAINRF and DAINVI

What Exists in the USAIP Document:	As discussed in Recommendation 2.2.2, there are only two alternate identification fields defined in the USAIP document that are to be used, not only for alternate identification, but also for retagging.
What is Proposed:	**As a corollary to Recommendations 2.2.1 and 2.2.2, we recommend that two special alternate animal identifier fields be created called the DAINRF and the DAINVI. These refer to the Device Animal Identification Number (DAIN) for both RFID tags (DAINRF) and visual tags (DAINVI).**
Reference for More Information:	Appendix D – USAIN / Animal Transaction Record (Alternate ID) Appendix E – Universal Animal Identification Number (UAIN) and the Use of Existing Identification Systems. Appendix F – UAIN White Paper Supplement Appendix G – Creating a National Visual Tag (DAINVI) to Compliment the UAIN Appendix H - DAIN/UAIN Cross-Reference Database

The concept of the UAIN should be adopted as recommended in Recommendation 2.2.1. This 2.2.3 corollary to Recommendation 2.2.2 is to create two special data fields, the device animal identification number data field for RFID (DAINRF) and the device animal identification number data field for visual tags (DAINVI). These two data fields would contain the current physical identifier attached to the animal for RFID and/or visual tag. Creating separate data fields for the DAINRF and the DAINVI allows the USAIP system to give official status to the unique physical identifier that is currently on the animal, and allows more rapid database referencing from the current DAINRF or DAINVI to the UAIN in the database for the animal. The USAIN is also referred to in this document as the UAIN with unique official status; this can now be a required field where DAINRF, DAINVI or both satisfy the requirement.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.2.3-A
Existing Page & Text:	Various
Recommended New Text:	See Recommendation 2.3 for specific wording recommendations regarding the DAIN.

2.2.4 Require Move-Out and Move-In Events, Reconciliation, and Chain of Custody

What Exists in the USAIP Document:	The USAIP document is ambiguous about whether it requires a double-entry system of pairing a move-in event at a new premises with a move-out event from a previous premises within a specified time period.
What is Proposed:	**We recommend that the USAIP document be modified to require a double entry "Chain of Custody" including procedures to automatically reconcile movements.**
Reference for More Information:	Appendix H – DAIN / UAIN Cross-Reference Database Appendix S - Chain of Custody Concept

The current USAIP document is ambiguous on pages 9, 23, 24, and 30 as well as illustration IV.1 about whether or not both move-in and move-out events are both required for a single movement from one premises to another. Requiring a paired move-out event and a move-in event for the same, single movement is typically called a double-entry system.

DoubleEentry Chain of Custody: Many livestock tracking companies have realized from experience that the only way they can ensure that livestock are located where the database says they are located is to impose a double-entry system thus creating a clear Chain of Custody. The Chain Of Custody concept is based upon pairing and verifying a move-in event at the destination location with a move-out event at the shipping location within specified time period. In addition, a reconciliation process is required to resolve discrepancies involving only a single entry.

Without a clear Chain of Custody, animal movements that are in transit and do not have a receipt confirmation back to either a centralized or distributed database may not be accounted for during a specific timeframe. This oversight would impact the national database's ability to traceback within 48 hours.

Breaking chain can miss premises: Furthermore, if there is not a clear Chain of Custody, there might be an intervening premises that housed the animal, which is not registered in the national ID database. An animal might leave ranch A for auction market B and be bought by buyer C. If seller A does not indicate the destination of their movement (auction market B), and if buyer C registered the animal without any reference to receiving it from auction market B, then it is highly likely the movement history for this animal would neglect its temporary residence at auction market B. Such an omission would clearly impact the integrity of the national database.

The BIE acknowledges that implementing a full Chain of Custody requirement may need to be a later deliverable, but it should be an option now and an integral part of the overall USAIP design.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.2.4-A
Existing Page & Text:	Page 9 – In section III.A, append the recommended text.
Recommended New Text:	Add the paragraph "A movement from one premises to another will require two animal movement events (see the Animal Event Code tables for individual and group/lots in Appendix B). First, a move-out event from the originating premises will be required with reference to the premises number of the receiving premises. Second, a move-in event to the receiving premises will be required with reference to the premises number of the originating premises."

Ref Number:	2.2.4-B
Existing Page & Text:	Page 54 – Data field 3 (Source/Destination Premises ID) in the USAIN/Animal Transaction Record is currently shown with a Required flag of N.
Recommended New Text:	Change the required flag for this field to a Y.

Ref Number:	2.2.4-C
Existing Page & Text:	Page 57 – No existing text
Recommended New Text:	Add a new data field, the Destination premises field, following data field 2 in the Group/Lot Movement Record Format. Currently, there is no method within the group/lot movement record to indicate the premises ID of the receiving premises for event code 3.

Ref Number:	2.2.4-D
Existing Page & Text:	No existing text.
Recommended New Text:	Explain the procedure for reconciling Chain of Custody. Appendix S contains a sample procedure that may be adopted by the USAIP.

2.3 Add Privacy and Efficiency for Premises ID and Allocation of Premises IDs

What Exists in the USAIP Document:	The current USAIP document jeopardizes the market relationships of existing cattle marketing participants because it does not sufficiently address methods for protecting the privacy of premises identification numbers to later buyers. This protection is important because later buyers, if aware of the premises identification of the "best cattle," may be able to directly contract with those premises, bypassing the middle market that plays a vital role in today's livestock industry.
What is Proposed:	**We recommend that premises identification numbers not be visible to commercial traders, but, because traders will want assurance that a valid premises number exists, each commercial transaction be accompanied with a confirmation code provided by the Data Trustee that the premises identification database has been checked and that a valid premises identification number exists**

	for that animal's prior location. This confirmation code would be similar to the confirmation numbers issued by hotels for a hotel reservation and will identify the Data Trustee.
Reference for More Information:	Appendix I - Privacy Concerns in a National Animal ID Program Appendix J - Public/Private Data in a National Animal Identification Program

The historical antagonism exists between segments of the beef industry has resulted in a lack of trust among these segments, and an unwillingness to share certain types of information. The potential for abuse is great in a system where everyone potentially has access to all location data via a Freedom of Information request (FOIA). Putting premises information on individual animals in the hands of anyone filing out a FOIA application or otherwise having access to the USAIP system will undoubtedly create resistance to the USAIP system from those who do not want their competitors to have access to their data. Likewise, exposing the premises identification number on an animal in a sale will potentially make it possible for a buyer in one segment to simply "go around" a supplier that he would normally buy from, and go directly to the supplier's supplier. As USAIP matures, buyers will want assurances that a valid premises identification number exists for each animal they buy. Otherwise they might be left "holding the bag" in the event of a traceback involving that animal.

Protecting premises IDs in commerce: Although the USAIP document states (Section IV.C.1) that "access to the premises repository will be limited to authorized users," we believe it will be very difficult for sellers to avoid providing their premises identification number to buyers in order to provide the buyers with some assurance the animal they are buying comes from a valid premises and has been registered. Likewise it will be very difficult for the government to protect the premises repository information from FOIA or other discovery. Such a concern is another reason for our Recommendation 2.1 for a "pull" database architecture with an intervening Data Trustee. In light of this, we recommend that a confirmation number be used to ensure the buyer that a valid premises identification number exists for the animal while the true, private premises identification number is not publicly exposed.

For all of these reasons, we recommend that in commerce and day-to-day operation, premises identification numbers not be exposed but rather, a confirmation code is paired with the USAIN to indicate that a valid premises number exists.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.3-A
Existing Page & Text:	No existing text
Recommended New Text:	Add text in section III explaining how the actual premises identification number will not be exposed during commercial transactions or during day to day operation of the system, but rather, a confirmation number will be generated which indicates a valid premises identification number has been assigned to the animal, and which points to that premises.

2.4 Add Necessary Data Elements for Certain Animal Event Codes

What Exists in the USAIP Document:	Fourteen Animal Event Codes are listed on page 55 of the USAIP document. Half of these codes do not, in our opinion, have sufficient data elements defined in the document.

What is Proposed:	**We recommend that the data elements required to support animal event codes 7 through 14 be more fully defined.**
Reference for More Information:	Appendix K - Inconsistencies Between Animal Event Codes and Animal Transaction Record Format

For approximately half of the fourteen event codes defined by the USAIP document to describe animal movements, the 17 fixed format, supporting data fields defined in the USAIN/Animal Transaction Record shown on page 54 are highly appropriate and supply all of the information required to support those event codes. However, beginning with animal event code 7, we believe that this and subsequent event codes have not provided adequate information via defined data elements to support the listed event. The intent may be to use the 50 characters of the Remarks field (field #13) to provide this information, but this is not clearly defined. If the Remarks data field is planned for this purpose, please see Recommendation 2.6 for proposed changes to how the Remarks field is to be handled.

For example, animal event #9 (Animal sighting) requires some level of consistent coding for the type and result of the animal sighting. If these data are random, free form comments entered into the Remarks field, they will not necessarily be easily processed, analyzed and compared. Animal event #11 (Slaughtered) does not define the coding that will be used to define method of death so that data can be compared across the various different groups inputting data. Standardizing the method of entering data to support these event codes will facilitate epidemiological investigators role in 48-hour traceback.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.4-A
Existing Page & Text:	No existing page.
Recommended New Text:	Add an appendix to the USAIP document that lists for each event code (whether animal or group/lot) all the data elements that are required for that event code. Identify which are to be pre-defined and which are to be coded in the Remarks column. See recommendation 2.5 below regarding the need to pre-format and sub-divide the Remarks column.

2.5 Pre-Format the Remarks Data Field for Each Event Code

What Exists in the USAIP Document:	The Remarks data field in both the USAIN/Animal Transaction Record and the Group/Lot Movement Record is a fifty-character field with no pre-formatting. By not specifying how and where data can be entered into this data field to support the various event codes, it will be difficult to compare data from one data entry to another. The effectiveness of the national system will thereby suffer.
What is Proposed:	**We recommend that the USAIP document be modified to sub-divide and pre-format the fifty-character Remarks column for certain of the event codes.**
Reference:	Appendix K - Inconsistencies Between Animal Event Codes and Animal Transaction Record Format

If the Remarks field is to be used to provide support information for certain event codes, relieving the system's need to predefine dedicated data fields, the fifty character Remarks field needs to be sub-divided and pre-formatted for each specific event code so that the data can be reliably parsed. Currently no procedure is provided for how data are to be entered into the Remarks data field.

Remarks field needs sub-field formatting: If the 50-character Remarks field is allowed to be a "free-format" field, there is a high likelihood that different organizations submitting data will format this field differently. Having idiosyncratic coding will substantially hinder the system's overall purpose of rapidly responding to animal health threats because the idiosyncratic use of the remarks field would require human intervention rather than allow the computers to effectively parse data. For example, if the Remarks field were used to store the country of origin for an importation event, and if there was no pre-formatting of how this country data would be encoded (both which positions or how a country would be represented), then one data supplier might indicated a Mexican origin by putting "MEX" in column 1 of this field, while another might put "From Mexico" in column 1, and a third might just put "M" in some other column. Without the USAIP document specifying the type and method of data entry into the Remarks field, an infinite number of coding schemes will be using, slowing down a traceback investigation.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.5-A
Existing Page & Text:	No existing page.
Recommended New Text:	As part of recommendation 2.5, the proposed new USAIP appendix should include the actual subdivision and pre-formatting to be done within the Remarks data field for each animal and group/lot event code.

2.6 Allow Data to be Transferred to the National Database Using XML

What Exists in the USAIP Document:	The USAIP document defines a fixed-record format for transferring records to the national database. The fixed record approach was first popularized in the 1960s. In today's computing environment, a fixed format record structure tends to be relatively inflexible and cumbersome.
What is Proposed:	**We recommend that data be communicated to the national database using <u>either</u> the proposed fixed record format or the XML record transfer format.**
Reference for More Information:	Appendix K - Inconsistencies Between Animal Event Codes and Animal Transaction Record Format Appendix L - Event Data Transmission Using XML

Extensible markup language (XML) is rapidly becoming the standard data exchange file format. Its primary advantage over older systems of fixed record file transfer systems is that new data elements can be added without a major revision of the record structure. Microsoft's use of XML in its Office 2003 productivity suite promises to make XML even more pervasive in the future.

***Fixed record formats are inflexible**:* Currently, the fixed-record format proposed in the USAIP document is not very flexible and will be difficult to add new data elements or modify their length. The USAIP document design may be thinking that the fifty-character Remarks data field might be used to accommodate such expansion, but this data field has its own issues as explained in the immediately preceding BIE recommendation. In any event, the Remark data field as defined in the USAIP document is still only limited to a total of fifty characters which imposes a limit to future system expansion.

While drafting the USAIP, there was a concern that if the USAIP document required data transfer exclusively via XML file format, then older software systems might be disadvantaged because they do not have XML output capability. It should be noted, though, that by requiring the fixed record format, the USAIP document is not reducing any workload on software vendors or government databases. Software vendors will still need to write an export file based on the USAIP file format regardless of whether this output file is in fixed record format or XML. However, by making either XML or a fixed-record format as possible data entry methods to the national database, the USAIP document could accommodate both the past and the future.

***XML allows expansion**:* The USAIP system complexity will not be substantially increased by allowing either record format and, by allowing XML, the USAIP would provide maximum flexibility for future system expansion. A future animal health issue may require the recording of certain vaccinations in addition to the information currently listed. Vaccine batch numbers may, for example, need be collected. If the data were transmitted via an XML record structure, adding these new data elements would be relatively easy.

Another concern about XML is that it could potentially increase the file sizes of data to be moved. This concern is not always true as is shown in the example below using a simple “move out” event:

Record structure for fixed format as per the USAIP document

04A123R69A321R962003080112231840123456789012bbb1bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb
bbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbbb

(record takes 149 bytes – note: “b” denotes spaces)

Record structure of the same record using XML format

```
<trx type-id="4"
    report-prem-id="A123R69"
    src-destin-prem-id="A321R96"
    trx-time="2003-12-16 16:09:00 CDT"
    uain-id="840123456789012"
    id-elec-read="1">
 </trx>
```

(record takes only 139 bytes)

XML is not always a larger record: Not only does the XML record structure consume 10 fewer bytes than the fixed format record in this instance, the XML record is self-describing, open, and concise. In addition, XML lends itself to data element modifications more easily than fixed-format. When an XML record structure is larger than the fixed record structure, and there will certainly be instances where this occurs, this increased space should not be given too much weight given modern data transmission, compression, and storage technology. The additional flexibility from XML far outweighs the potential cost of additional space.

Finally, it should be noted that XML is not the only technology needed for data interchange among heterogeneous databases, but it is an important precursor. Other security and data mapping technologies are required.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.6-A
Existing Page & Text:	USAIP Appendix B, pages 53 through 57.
Recommended New Text:	Add to the existing text of the tables in USAIP Appendix B the XML tag name for each data element by adding a column to each of the record format tables. Appendix L provides a suggested tag name for each data element. Also explained in this appendix is how data can be communicated to the national system using either a fixed record format or XML.

2.7 Add Error Detection Field to Record Header File using CRC Checksum

What Exists in the USAIP Document:	Appendix B (pages 53-57) of the USAIP document describes the file format for transmitting one or more records to the national ID system for premises updates, individual animal updates and lot updates. Aside from listing as data element number 3 of the record header the number of records that follow, there is no mechanism for determining data integrity.
What is Proposed:	**We recommend incorporating a simple CRC-32 checksum as data element number 5 of the header for each of the premises, individual ID, and lot/group records.** This addition helps ensure that the data received at the national database were the data actually sent; that data have not been changed – either accidentally or maliciously.
Reference for More Information:	Appendix M - Error Detection in Transmitted Data Files Using a Cyclic Redundancy Check Checksum

This recommendation is critical to ensure data integrity. Implementing this recommendation helps protect against unexpected modification of the USAIP data records, whether inadvertently during transmission errors or by a malicious act.

The current draft document only has one method for ensuring data integrity, a record count in the header. A record count is important but not sufficient to guarantee data integrity during transmission. A record count cannot ensure that the data received were the data actually sent. One or more bit errors may be made within a record without the record count being adjusted, resulting in inaccurate data being transmitted.

The incorporation of a simple CRC-32 checksum into the USAIP data files will provide a highly reliable, low overhead method to ensure that no unexpected modification of those files has occurred, and that the received data are in fact what were sent. The CRC-32 checksum would be computed for the entire packet – header and each individual record.

The proposed checksum digit is above and the error handling procedures outlined in the USAIP document Appendix G.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.7-A
Existing Page & Text:	Page 53 – No existing text
Recommended New Text:	Add to table "Premises Upload Record Format" file header record data element 5 with field description CRC-32 Code, data type Binary, size of 4, and example of 229 041 176 008.

Ref Number:	2.7-B
Existing Page & Text:	Page 54 – No existing text
Recommended New Text:	Add to table "USAIN/Animal Transaction Record Format" file header record data element 5 with field description CRC-32 Code, data type Binary, size of 4, and example of 229 041 176 008.

Ref Number:	2.7-C
Existing Page & Text:	Page 57 – No existing text
Recommended New Text:	Add to table "Group/Lot Movement Record Format" file header record data element 5 with field description CRC-32 Code, data type Binary, size of 4, and example of 229 041 176 008.

2.8 Make Species Data Element a Required Field for Animal Record

What Exists in the USAIP Document:	Field number 7 of the record description for the USAIN / Animal Transaction record shown on page 54 of the USAIP document indicates that the species field is not a required field.
What is Proposed:	**We recommend that the species field is a required field for the USAIN / Animal Transaction record.**
Reference for More Information:	Appendix N - Species Record Element Needs to be Required Field

This recommendation has been made to improve the consistency of the USAIP document. On page 57 field number 7 of the record description for the Group/Lot Movement Record Format indicates that species is a required field. We concur that species should be a required field for both individual animal movements and group movements.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.8-A
Existing Page & Text:	Page 54, Field number 7 shows required = N
Recommended New	Page 54, Change required for field number 7 to Y

Text:	

2.9 Require Additional Data for Foreign Animal Events

What Exists in the USAIP Document:	The Animal Event Codes shown on page 55 of the USAIP document list two events relating to animal imports and exports. The document does not provide any specific information that should be recorded.
What is Proposed:	**We recommend that for animal importation (animal event code 7), the document be modified to at least include** • Country of origin. • Premises within the foreign country, if applicable, from which the animal came. • Border station port number as the move-in transaction, and the premises ID of the premises to which the animal is consigned in the USA and/or the carrier trailer license number. Other data elements to support tracking across international borders should be added as needed by USDA personnel. These data elements, though, should be clearly identified and be part of the USAIP document in the technical appendices. All of these data elements should be stored in the Remarks field #13, and this fifty-character field should be pre-formatted with fixed length sub-fields for each of these data elements.
Reference for More Information:	Appendix O - Foreign Animal Traceback See also Recommendation 2.5 and Appendix K for the need to pre-format the Remarks data field #13 for each specific animal event code.

The USAIP document does not make any specific reference to the process in which foreign animals will be controlled and monitored entering or leaving the United States. Nor is there any reference to any pre-existing policies governing this process or to the type of information that should be collected.

Given the recent cross-border BSE event, the need for more specific information in the USAIP document is underscored. Without specifying the specific data elements to be collected for Animal Event Code 7 (Importation), the USAIP document is incomplete. Information on animal exports is also required and the type of information collected and its formatting should be determined by USDA staff and put into the final USAIP document.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.9-A
Existing Page & Text:	Page 55 – No existing text
Recommended New Text:	Following the Animal Event Code table on this page, there should be a list of the specific data elements that are associated with each of the animal event codes and how these data elements are to be pre-defined within the fifty character Remarks column, data field number 13 in the USAIN/Animal Transaction Record and data field number 8 in the Group/Lot Movement Record.

	Specifically for Animal Event Code #7 (Imported – Animal is imported into the USA), the following data elements are recommended to be collected: • Country of origin. • Premises within the foreign country, if applicable, from which the animal came. Border station port number as the move-in transaction for the "move-in" transaction, and the premises ID of the premises to which the animal is consigned in the USA and/or the carrier trailer license number.

2.10 Expand Group/Lot Event Codes

What Exists in the USAIP Document:	The Group/Lot Event Codes shown on page 57 of the USAIP document do not include events for moving a group/lot in or out of the United States.
What is Proposed:	**We recommend adding group/lot event codes that handle the importation or exportation of a group/lot in or out of the U.S.**
Reference for More Information:	Appendix J - Public/Private Data in a National Animal Identification Program Appendix O - Foreign Animal Traceback

Currently, there are no event codes for groups or lots that handle the movement of groups of animals into and out of the United States. We believe this is an oversight unless it is the USAIP policy to only allow movement in and out of the United States via individual animal identification. If this is the USAIP policy, it should be so stated.

Also, if this is the policy, then the group/lot event codes need to be expanded to allow an individual animal with a previously defined individual animal identification number to be entered into or taken out of a defined group/lot. The "Alternate Animal ID" section on page 56 describes how the lot number of an animal is to be stored in one of the alternate ID fields if an individual animal ID is assigned to that animal, but there is no group/lot event code for extracting an animal from a group.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.10-A
Existing Page & Text:	Page 57 – Nothing currently exists.
Recommended New Text:	Add importation and exportation event codes for groups/lots (codes 6 and 7)

Ref Number:	2.10-B
Existing Page & Text:	Page 57 – Nothing currently exists.
Recommended New Text:	Add group/lot event code 8 to move individual animal into a group/lot and event code 9 to extract from a group/lot an individual animal.

2.11 Include Full Set of Database Functions for the National Animal ID Database

What Exists in the USAIP Document:	The current USAIP document describes a database that is "write-only". In other words, the system as currently described can only accumulate information, and only allows for one of the four basic database functions. For example, there is no mechanism for producers to see what transactions are associated with each of their premises (read), or to request changes to information that may be inaccurate (update or delete).
What is Proposed:	**We recommend adding database functions that are currently missing from the USAIP document (read, update and delete). Producers who send data to the database should be able to review that data (read) and make necessary corrections (update and delete). However, we recommend no data entered into the national identification database or one of its Data Trustees is actually ever deleted, and there is a clear audit trail of all data updates. Updates and deletions are just recorded as transaction events and the database can either report on the most recent value or the historical changes to a field.**
Reference for More Information:	Appendix P - CRUD Analysis on the Proposed USAIP Database Appendix Q - USAIP Needs to Be More than a Write-Only System

There is no mechanism in the USAIP document for feedback to those supplying data to the system, and this deficiency needs to be corrected. Producers and/or processors should have the ability to check the accuracy of inventory in the system currently assigned to them. Neglecting this review function creates potential problems for the national ID database to be "out of sync" with reality, and could promote a sense of unease in producers and processors with respect to the national ID program.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.11-A
Existing Page & Text:	No existing page or section.
Recommended New Text:	Add a new appendix (Appendix J) that explains the mechanism by which the three missing database functions (read, update and delete) are to be implemented, and how producers and others supplying data to the national database can review their transactions and make appropriate adjustments to ensure accurate data. Guidelines and procedures should be created to allow incorrect records to be updated and/or deleted if necessary. This will reduce ambiguity in the dataset that a USDA/APHIS official will have to utilize in the event of a traceback situation by eliminating incorrect data. This will also increase the efficiency of the query and analysis by enabling the official to look at only correct data instead of first trying to determine which records are correct and which ones might not be correct before performing an analysis of the data. Procedures must be included in the national system, which restrict access to records only to those authorized government agents, or to those possessing the necessary passwords for a specific premises or premises. Furthermore, only those who have owned an animal may make changes to that animal's record, and a clear audit trail must be maintained for all changes to previously entered records.

2.12 Expand the List of Data Security Features Needed in the National System

What Exists in the USAIP Document:	Section IV.C.4 and IV.C.6 on page 26 of the USAIP document lists six and five security issues respectively that the system needs to address for premises and individual or group records. While these are all important, they are by no means the full range of security issues that need to be defined in the USAIP design document prior to system implementation.
What is Proposed:	**We recommend that the text of Section IV.C.4 and IV.C.6 be expanded as described below, and that a separate, new appendix be added to the document that explains how each of these security items will be handled in the USAIP.**
Reference for More Information:	Appendix R - Data Security

The current USAIP document gives a very broad and general description of the proposed security measures of the National Animal ID Database Application. Security across the multiple layers of the application plays an important role in the ultimate success of this system. To date the specific security layers and needs of this application have not been thoroughly explored or identified, and no protocols or procedures have been developed to support these needs.

Specific Recommendations:

This recommendation is implemented via the following proposed changes to the document:

Ref Number:	2.12-A
Existing Page & Text:	Page 26 – Section IV.C.4 and Section IV.C.6
Recommended New Text:	Replace with the following: "Recognizing the security and privacy issues, the plan calls for security procedures surrounding each of the following areas: 1. Hardware/Software • Physical Security (Facility Security Measures) • Network Security • Firewalls • Load Balancing • Redundancy • Backup/Off Site Storage • Disaster Recovery 2. Users • Administration and Management of User Names and Passwords • User Roles • User Level of Access • User Validation • Session State 3. Data

	• Data Encryption • Use of Secure Socket Layer (SSL) Each of these procedures is discussed more thoroughly in Appendix R. Some of the key procedures include:

Ref Number:	2.12-B
Existing Page & Text:	No existing section.
Recommended New Text:	Add a new Appendix to the USAIP document that describes the desired security procedures for each of the areas listed in IV.C.4 and IV.C.6.

3. Appendix A – BIE Participants

AgInfoLink Global
AgInfoLink, a member of the John Deere FoodOrigins™ Alliance, is a leading provider of customized information and traceability solutions for the meat and livestock industry. AgInfoLink provides flexible and easy to use management tools for all production chain segments from ranch and farm through processor(s) to the retailer. These tools implement traceability on individuals or groups to increase profits for each chain segment as well as meet regulatory requirements. The core of AgInfoLink technology is the secure sharing of pre-approved information from one owner to the next within the chain, inter-connecting dissimilar databases. AgInfoLink products make it simple to implement systems for individual animal management, source-verification, and processes documentation. For more information, visit www.aginfolink.com.

APEIS
APEIS (Animal Permanent Electronic Identification System Inc.) was created to individually identify and track information on the worlds beef supply and enhance the quality of beef and long-term profitability of cattle producers. APEIS has created a fully integrated cattle-tracking system that is internationally accessible while maintaining a level of integrity, security, and user friendliness necessary to accomplish this monumental feat by today's beef producers. The "Trax" family of products utilize a patented tag tracking method that will enable compliance with upcoming regulations.

eMerge Interactive
eMerge Interactive, Inc. is a technology company providing individual-animal tracking, food-safety and animal information solutions to the beef production industry. The Company's individual animal-tracking technologies include CattleLog™, an exclusive USDA Process Verified Program providing data-collection and reporting system that enables beef-verification and branding. The Company's food-safety technologies include VerifEYE™, a meat-inspection system that was developed and patented by scientists at Iowa State University and the Agricultural Research Service of the USDA for which eMerge Interactive holds exclusive rights to its commercialization. For more information, visit www.emergeinteractive.com.

IMI Global
John Saunders founded IMI Global in 1995, anticipating the need for a more sophisticated system for capturing, recording and analyzing critical livestock information. Today the company is on the cutting edge of creating customized integrated livestock software that helps customers - from the rancher to retailer - be more profitable. The IMI team has worked with some of the largest livestock organizations in the U.S., providing them with agricultural software products and consulting services specially tailored to meet each customer's needs. Some of IMI's products include Web Integrator™, Chuteside™, Chuteside Lite™, and Beef Passport™. For more information, visit www.imiglobal.com.

MicroBeef Technologies Ltd.
Micro Beef Technologies is a cutting edge, research and development based, innovator of patented computerized management systems for comprehensive individual animal information collection and management decision-making and has over 33 years experience pioneering information, marketing, health and nutrition systems. MBT introduced the beef industry's first individual animal identification and food safety assurance traceback system in 1986 with the revolutionary DRUG-TRAC® Animal Health System, which has individually tracked and managed millions of cattle. The ACCU-TRAC® Electronic Cattle Management System has utilized RFID technology since the early 1990s for individual animal data collection and traceback along with advanced management and marketing practices. MBT's technology portfolio includes 50 U.S., U.K., Canadian, and Australian patented inventions. The majority of the fed beef industry uses MBT's technologies. For more information visit www.microbeef.com.

4. Appendix B – Push/Pull Database Technology

Although the USAIP document indicates that the USAIP system could be implemented either as a single, central database under government control or a seamlessly linked set of local databases (p. 9), the document focuses most heavily on the central database architecture as shown in Figure 4.1 below:

Figure 4.1 "Push" Database Architecture

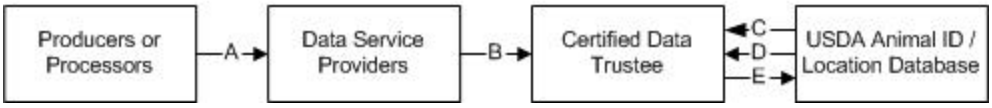
Modern database technology allows data to be distributed among separate and heterogeneous databases and only brought together at the appropriate time. This technology is what was meant by the USAIP's document indication that the USAIP system might be created using a seamlessly linked set of local databases.

The world's credit card system, for exa mple is one of the ways this is done. It is not based upon a single, central database. Rather, the credit card system maintains the confidentiality and separateness of each bank's data until the moment of the transaction. When a retail transaction occurs, the merchant's credit card terminal reports the consumer's card number and the merchant identification to the credit card system (e.g., Visa). Visa then queries both the merchant's bank to retrieve relevant merchant information and the consumer's bank to obtain the relevant consumer information. It is only at this instant, the specific time of need, that the relevant data is married and exposed to a central database in the form of a credit card transaction.

Since these credit card transactions have routinely been accomplished globally in a matter of a few seconds, it appears that providing 48-hour traceback on individual animals could easily be accomplished.

In its most simplistic form, the system of seamlessly linked set of local databases is illustrated in Figure 4.2 and is referred to in the remainder of this appendix as the "pull" architecture.

Figure 4.2 "Pull" Database Architecture



"Pull" Database Architecture

The diagram above illustrates the concept of the "pull" database architecture. The heart of the "pull" approach would be the creation of a new role, the "Data Trustee (DT)". These would be entities with which data service providers would be willing to entrust their data. DT's would have to register with and meet the requirements of the state and federal government. Failure to meet certain performance requirements would result in a DT being de-certified. BIE would be an example of one such DT although there are likely to be several of these.

The specific "pull" architecture proposed by the BIE is shown in Figure 4.1on the next page. The following discussion refers to that illustration.

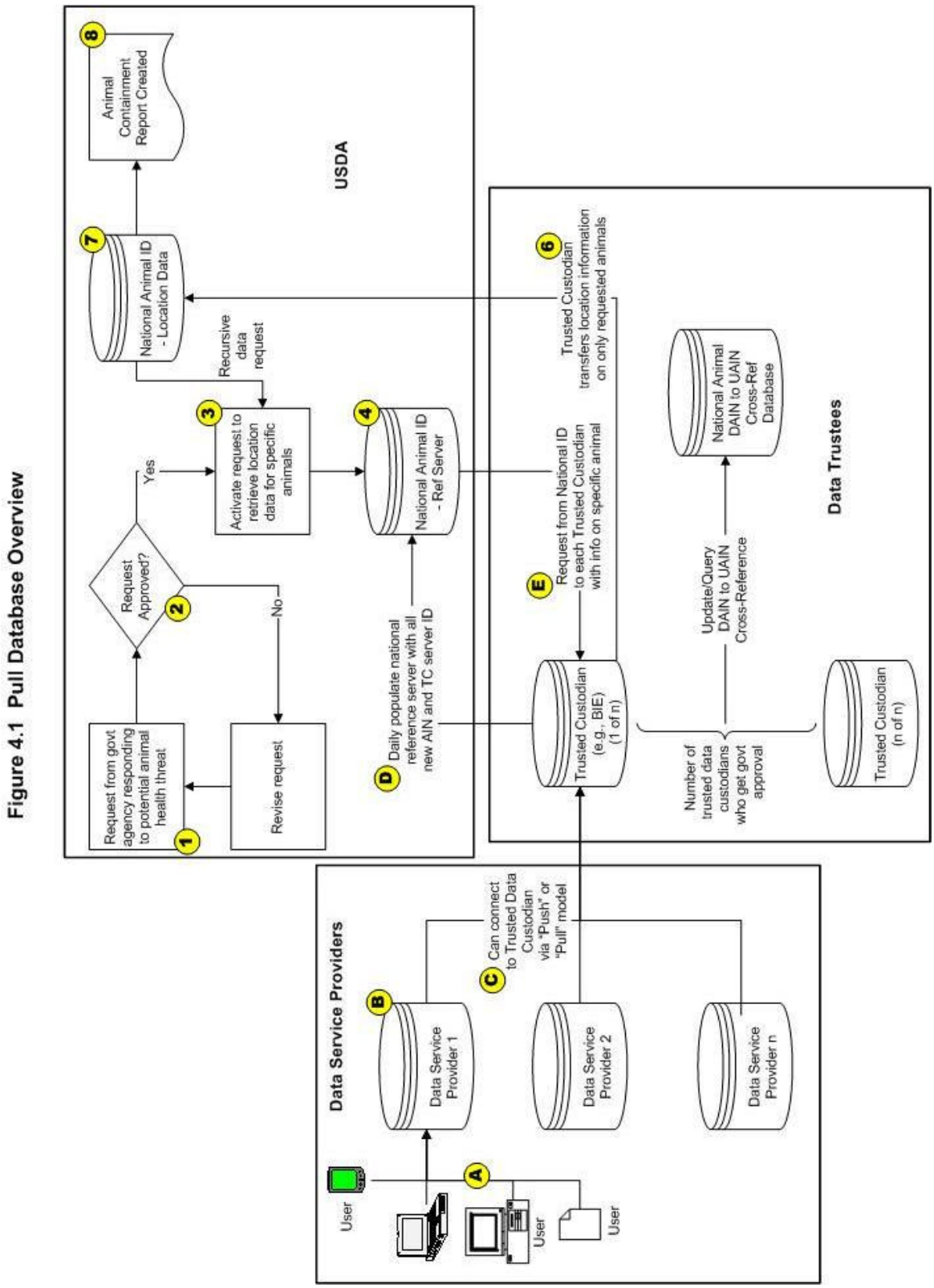


Figure 4.1 Pull Database Overview

Producers and processors would continue to select their preferred data service provider, similar to the present situation (steps a and b). Each data service provider would then select which DT they would use to interconnect with the national identification system.

The DT would retain all location data received and only pass to the government the new animal transaction received since the last communication with the government. No other data would be sent to the government database, just the UAIN and the address reference of the DT that currently stores the location and other data about that animal. It is anticipated that the DT would send a daily file to the national system of all new UAIN transactions the custodian saw from its data service providers during the day.

Knowing the UAIN, the national system would be able to monitor the number of animals in the system and the address of the database containing information about those animals. It would not know who owned which animals and where those animals were located until such information was required.

In the event of a valid requirement for information, the government system (step 1) would determine which animals would be required to contribute information for the search beginning with the index animal(s). A request from the government server would then go to each DT server having information about that animal and the time window under consideration (e.g., a three week period beginning on a specific date) (steps 3, 4 and 5).

The DT would then automatically return to the government the specific traceback information as specified by the USAIP file formats #1 and #2 as appropriate (step 6). This returned information would populate the individual animal identification database (step 7). The initial request from the government database might also request the IDs for all time/location cohorts of the index animal(s) are returned. Recursive calls from the government database to the DT databases would be made until all animals required for the analysis are populated, and the animal surveillance report is generated (step 9).

Estimates indicate that this data can be requested and retrieved in a matter of several minutes to, in the worst case, a few hours, using the data formats specified in USAIP file ID #1 and #2. Certainly well under the 48-hour service performance requirements. Once the national identification database is populated with the location data for all affected animals, the appropriate report(s) can be produced by the national system.

“Pull” System Advantages

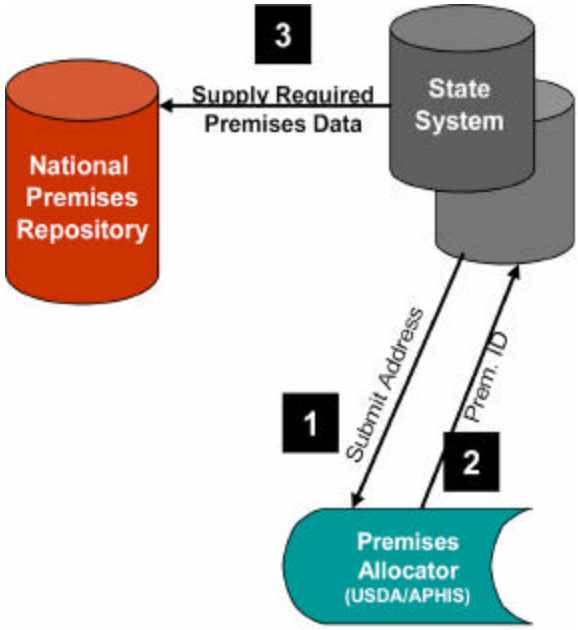
The “pull” system has none of the privacy or data mining concerns that the “push” system has. Producers or processors will select in the marketplace those organizations/companies they trust to hold their data for them. Data would then be safe from unauthorized access, and the producer or processors would be free to move their data repository to another custodian if they lost trust in their DT.

Furthermore, the DT could be the location where public/private premises identification translation occurs to further provide additional data confidentiality (see Appendix C).

5. Appendix C – Premises System

The current USAIP Premises System is outlined as follows:

1: The state system premises enrollment begins by requiring the producer or operator of an entity to provide the address (or legal description if no address is available) of the premises. The state system, through a machine-to-machine interface, passes the address to the USDA/APHIS Premises Allocator. The Premises Allocator determines if the address is valid and if the address has previously been allocated a U.S. Premises Number.



2: When the address is valid and has no premises ID on record, the Premises Allocator returns the next available sequential premises number to the state system. If a U.S. Premises ID Number is on record, the Allocator will return that premises number. The state system completes the identification/enrollment process of the premises, collecting as a minimum the data elements required by the Premises Repository.

3: The state system updates the Premises Repository according to prescribed update procedures and file format specifications. This includes updates of new and revised premises records daily and monthly "master" updates. The "master" updates contain all records from the State System.

BIE believes that it can reduce the amount of system infrastructure and support staff necessary for a state system to operate by acting as an intermediary between the state system and producers. Instead of dealing directly with thousands of producers, the state system could simply deal with BIE, provided that the state is willing to allow BIE to interact with it on behalf of the producers. BIE would develop an automated interface for producers to apply for and receive their U.S. Premises Numbers, as well as a means of updating contact information and other required data. BIE would then forward this data on to the state system on behalf of the producers, thereby providing a service to producers and easing the load on the state by requiring it to deal with only one entity – BIE – instead of thousands of producers.

6. Appendix D - USAIN/Animal Transaction Record (Alternate Animal ID)

This document discusses the Alternate Animal ID fields in the current USAIN proposal.

Current Proposal Record Description

The current USAIN Proposal allows for two Alternate Animal Identification Descriptions in the following format:

Field No.	Field Description	Data Type	Size	Required	Example
15	Alternate Animal ID 1	Character	17	N	Alternate pre-existing official Identification number if USAIN not available, Lot ID number if animal has USAIN number and was moved out of a lot, old USAIN number if tag replaced
16	Alternate Animal ID Type 1	Character	1	N	(A)merican ID,(U)SDA eartag, (R)FID, (B)reed registry number,(L)ot number,(T)attoo, required if Alternate ID (field 15) is provided, R(E)placement USAIN number if event code 6 used
17	Alternate Animal ID 2	Character	17	N	Second Alternate pre-existing official Identification number if USAIN not available, Lot ID number if animal has USAIN number and was moved out of a lot, old USAIN number if tag replaced
18	Alternate Animal ID Type 2	Character	1	N	(A)merican ID,(U)SDA eartag, (R)FID, (B)reed registry number,(L)ot number,(T)attoo, required if Alternate ID (field 16) is provided

Alternate Animal ID (From page 56 in USAIP)

Up to two pre-existing official ID numbers such as American ID, USDA series numbers,

RFID and Breed registry numbers can be used during the transition period if an USAIN number is not yet available. If an alternate US Animal Identification Number is used, an alternate animal ID type code must be submitted to define the type of alternate ID.

Alternate ID and identifier together should create a unique ID for the animal. In the case an animal loses a tag, this field can be used to report the previous USAIN number of the animal. The alternate ID type code must reflect an “R” to indicate the replaced USAIN number.

The alternate ID and type code fields will be phased out in the future and these fields will only be used to report the USAIN number of an animal that lost a tag.

The secondary use of the alternate animal ID field requires that if an animal was previously assigned to a Lot ID and received an individual animal ID (USAIN number), the Lot ID# the animal was originally assigned to needs to be supplied in the Alternate animal ID field, and the Alternate animal ID type field needs to reflect that the number entered is a Lot ID.

Limitations of Current Proposal

- Primary limitations of the proposed Alternate Animal ID description
- Data fields are hard coded into the system and therefore restrictive
- The current format does not allow for additional, alternative, or future ID Types (i.e.: Bar Code, DNA String, Optic Scan Image Blob etc.)
- The current format only allows two slots for Alternate IDs (Animals typically have multiple tags)
- Doesn't provide for using multiple production IDs when DAINs are lost
- Current USAIN and all Alternate ID Types are device dependent (tags can be lost or unreadable)

Requiring a DAIN (Device Animal Identification Number)

While the individual animal transaction record format requires the animal's universal animal identification number (UAIN), requiring a DAIN such as a Radio Frequency ID tag number (DAINRF) or a Visual ID tag number (DAINVI) would facilitate timely trace back and reinforce the accurate identification of each animal. Adding a new DAIN field to the animal transaction record and making it a required field will satisfy the needs of both the USDA who wants to use ISO RFID tags and most state vets who want to use a unique visual ID tag.

Recommendations:

- Alternate Animal ID
- Expand types of authorized animal IDs
- Expand alternate ID type field to three characters
- Alternate ID field should permanently be used in conjunction with the AIN, not just during the transition period, in order to facilitate re-identification in the event of a lost tag
- For verification and rejection purposes the database should store as many IDs as possible
- BIE recommends allowing more than two alternate IDs, with the total number of alternate IDs being designated with a variable-length counter
- Alternate ID field should be extended from 17 to the total number needed per transmission (Microsoft GUID is 32 characters)
- Adding a new DAIN (Device Animal Identification Number) field to the animal transaction record and making it a required field
- Access to AIN devices must be possible with minimal delay to producer

7. Appendix E - Universal Animal Identification Number (UAIN) and the Use of Existing Identification Systems

The current numbering system proposed for permanent identification of individual animals in a database utilized for 48-hour trace back is based upon a temporary physical identification device which is not a permanent identification device at all. It is only the animal identification until it is either separated from the animal, fails to automatically read with an RFID reader or the printed number is illegible to the observer. At the occurrence of any of these events, the device must be replaced with another device having a different number, thus the original device number is not permanent. Both device numbers need to be linked in the reported database record with a permanent identifier in the database. This methodology has been utilized in existing systems for many years with success.

As documented in Appendix D, the individual animal transaction record format needs to require the animal's UAIN, including the DAINs, which will facilitate timely trace back and reinforce the accurate identification of each animal.

This provides both a unique and permanent database animal ID number for the individual animal record and a unique device number to be used on the animal until it is required to be replaced with a different unique number on the same animal.

The following examples will reinforce the requirement and value to use a permanent individual animal record number in the database that ties all associated DAIN's to the individual animal:

1) Ease of grandfathering existing devices and transitioning from those to the final system over time during the transition period.
2) Enables all animals in a group / lot to be assigned UAIN identifiers whether or not an individual device is attached or recorded so that if a group / lot is converted to a co-mingled group the individual record is already present in the database with which to match the device number.
3) Enables an accountable method of recording individual and group disease intervention actions such as vaccines or treatments in the individual records for all animals whether the group animals utilize an individual ID device or not.
4) Enables a more accurate total current inventory count total of all animals in the database when group / lot ID systems are used by assigning UAIN identifiers to all animals in the groups in the database so the animal counts can be utilized for compliance.
5) Aids in implementing the National Identification Plan more quickly by continuing to utilize existing animal identification devices linked to the UAIN until all animals arriving at pre-harvest confinement feeding premises already have a functionally acceptable RFID device previously attached.
6) Recognizes the uniqueness of both multi-use and single use device identifiers, which both have an ISO-compliant unique number and may be used to lower the cost of use.
7) Provides more accurate use of replacement devices and production type identifiers to aid in the trace back.
8) Provides more flexibility in acceptance, transition and continuing methodologies matched to the specific task.
9) More flexibility in utilizing future enhanced technologies, which may improve accuracy and speed of trace back.
10) Lowers the cost of meeting regulations by taxpayers and the industry for implementation.
11) Lowers the resistance by industry relating to current management system identifier changes required.

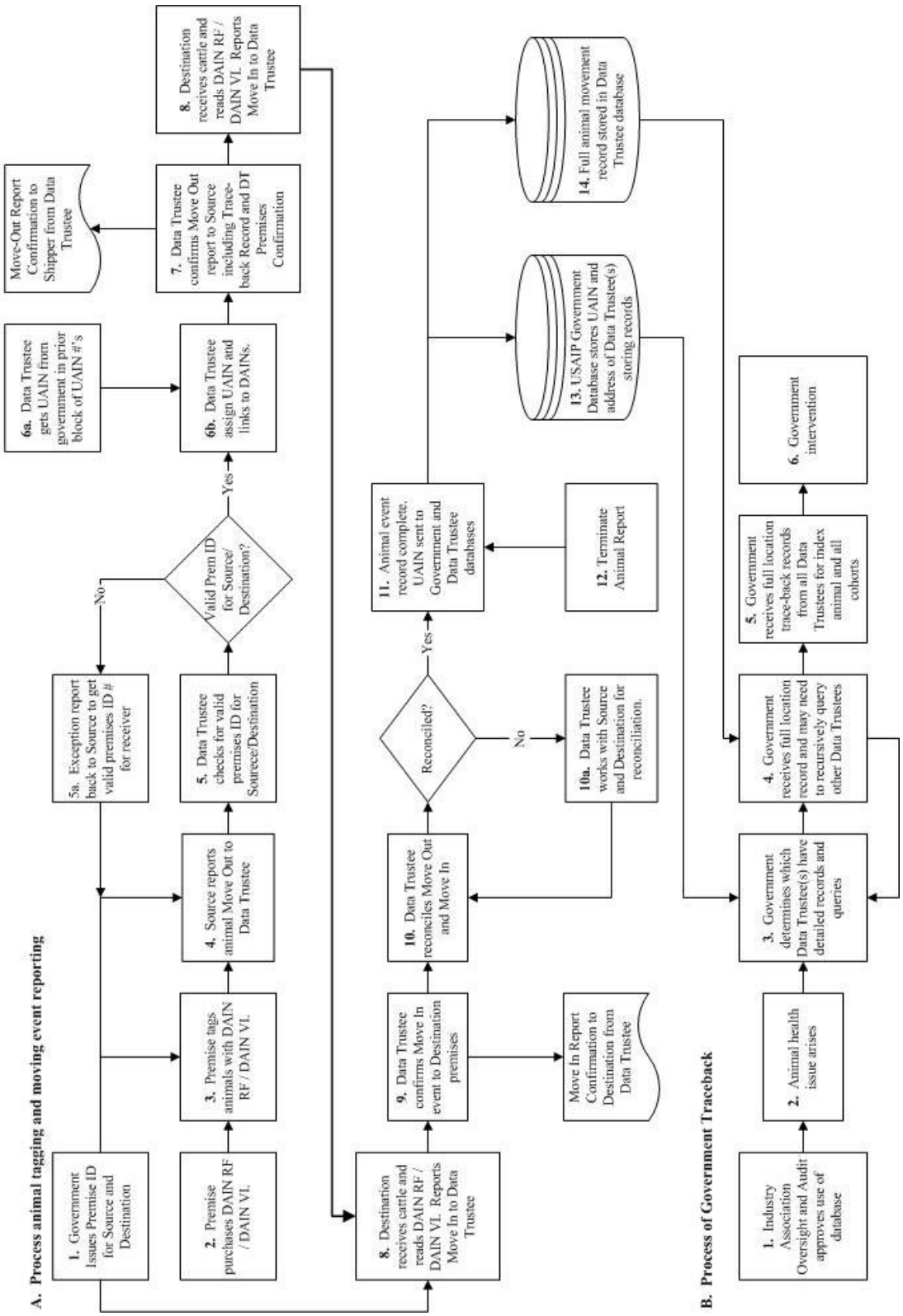
12) Creates a truly permanent individual animal record identity for permanent recurring analysis of system performance long after the device is retired.

13) Eliminates the need for multiple RFID tags per animal during the transition years when an earlier device that is used for production is not accepted for trace back.

14) Implements a permanent ID number for each animal with the UAIN and DAIN regardless of what type of identification device is used now and in the future.

15) Uses a unique animal number in the computer database without limiting the type and capability of the device used for both National ID and animal production management purposes.

Figure 7.1 BIE National System Animal Movement Cycle and Traceback Reporting Steps



BIE National System Animal Movement Cycle and Traceback Reporting Steps Illustration (see Figure 7.1)

The Data Trustee (DT) performs the function of:

1. Service Provider
2. Universal Animal Identification Number (UAIN) Manager
3. Tag Distributor

A. Process of Animal Tagging and Movement Events

1. Premises obtains Premises Identification number from auto allocator
2. Purchase of Device Animal Identification Number (DAIN) - Premises purchases identification devices from unrestricted sources of the following types. One or more of the following DAINs is required.
   - Official DAINRF – Any ISO
   - Compliant Tag (UAIN or other)
   - Official DAINVI
   - Alternate Visual Tag
   - Retinal Scan
   - DNA
   - Brand/Markings
   - Other
3. Tagging and Moving Animals

   Source or destination premises tag each animal with at least one required DAIN. Both DAINRF and DAINVI are recommended. As many alternate identification devices as desired may be used.

   With each movement a Move Out report and Move In report must be filed and reconciled. The premises works together with the DT for assignment of UAINs to the Move Out/Move In reports following the check for valid premises identification of the Shipper and Destination premises (Under certain circumstances, a 24-hour time period may be allowed for the Source to obtain a premises identification number and report.)
4. The Source Move Out report is provided to the DT by following the procedure outlined for reporting movements of animals.
5. Valid Premises Identification Check

   DT checks for valid premises Source and Destination premises identification prior to reporting.
6. Move-Out Report
   - DT assigns UAINs (previously allocated to the DT by virtue of being an UAIN Manager) sequentially for each animal and links one or more official DAINs and all other alternate identification devices to the UAIN in the individual animal record in the DT database.
7. Move-Out Confirmation Report
   - A traceback record is prepared using current and other data (if any) from previous reports to provide a confirmation report to the shipper.
   - The Premises ID numbers for the Source and Destination are recorded in the DT database, however for confidentiality purposes a premises validation confirmation statement for the DT performing the service (a permanent non-participant number) is issued in its place.
   - When the report is complete, the DT sends it to the Source, and to the Destination at the Destination's request. This is the primary report used for commercial and regulatory purposes in cattle movement as proof of recording in the certified database.
8. Destination Move-In Report

This report is sent to the DT as a receiving record to validate the receipt of the animals.

9. Move-In Confirmation Report

This report is prepared by the DT and sent to the Destination to validate that the report has been recorded in the certified database and includes the information in the Move-Out confirmation report for the Destination to utilize when and if another movement or event occurs.

10. DT Reconciliation Process

This process is required in order to account for and correct discrepancies in the number of animals , or the additional identification devices, or absence of identification devices compared to expected.

11. Move Record Complete

Following reconciliation, this record is completed by the DT and certain information from the record is provided to the Destination, the Source, DT database and the Government database.

12. Animal Termination Report

Termination of an animal occurs following a dead event or a slaughter event by completing an event transaction or report. This termination record is sent to both the DT and Go vernment database.

13. Government Database Record

For each animal, at the completion of the event record the DT will forward the UAIN and the DT identification to the Government database so that the complete animal record may be obtained in the case of a confirmed FA disease case.

14. DT Database Record

For each animal, at the completion of the event record the DT will forward the complete record to the DT database for confidential and secure storage and obtainable by the Government in the case of a confirmed FA disease case.

B. Process of Government Traceback

1. Oversight

A coalition of Beef Industry Organizations will conduct the oversight and audit process for both the DT database and the Government database to ensure accuracy, completeness, confidentiality, and security.

2. When an animal health issue arises the Government Traceback process is initiated.

3. Government determines which Data Trustee(s) have the detailed records and queries the DT Database.

4. Government receives full location record and may need to recursively query other Data Trustees

5. Government receives full location traceback records from all Data Trustees for index animal and all cohorts

6. Government Intervention:

- The government will determine and implement an intervention strategy. The DT traceback capability will be able to record testing and intervention practices as they are employed in the industry to aid in controlling a disease.

National ID System Numbering Summary

A. Database Numbers	Classification	Official/Allocated
1.Premise Number in Database	Unique/Permanent	Yes
2.Non Producer Participant Number in Database	Unique/Permanent	Yes
3.Individual Animal Number In Database UAIN	Unique/Permanent	Yes
B. Physical Device or Method (one or more linked to UAIN)		
1.Official DAINRF Any ISO	Unique	Yes
2.Official DAINVI	Unique	Yes
3.Alternate Visual Device	May be Unique	No
4.Alternate Retinal Scan	Unique	No
5.Alternate DNA Profile	Unique	No
6.Alternate Brand/Markings	State Unique	State
7.Alternate Other	May be Unique	No
C. Group / Lot ID	Unique	Yes

1. Premises ID
    - ID allocated by government
    - 7 characters
    - Unique in database
2. Non-Producer Participant ID
    - ID allocated by government
    - 7 characters
    - Unique in database
3. Universal Animal ID Number (UAIN)
    - Number allocated by government
    - 840 ISO number
    - Number format 840 + 12 digits, starting at 2 billion
    - The only unique, permanent ID in database
4. Official Device Animal ID Number RF (DAINRF)
    - Any ISO RF device
    - Country/manufacturer code + 12 digits
    - Multiple types of ISO-compliant devices with unique numbers
5. Official Device Animal ID Number Visual (DAINVI)
    - Number allocated by government
    - Visual tag format 999-999-999, starting with 000-000-001
    - Multiple types of visual devices with unique numbers
    - Official number on tag bottom – can print existing ID system on tag
6. Alternate IDs
    - Non-allocated
    - Multiple methods, non-unique
7. Group / Lot ID
    - ID allocated by government

- Premises ID plus date

8. During Transition Period

- Minimum requirements are UAIN in database and one DAIN
- DAINRF or DAINVI required
- Can have both DAINRF and DAINVI

9. After Transition Period

- Minimum requirements are UAIN in database and DAINRF
- Can have both DAINRF and DAINVI

Recommendation

It is the recommendation that USAIP be modified to utilize existing identification systems and freely available devices used in the beef industry in order to aid in the implementation and operation of the identification systems to meet the 48-hour traceback goal.

Utilize a computer-generated sequential permanent identification number throughout the information exchange system for each individually identified animal in order to have a permanent identifier in the system with which to link all physical identification devices that may be used now and in the future. This allows the use of current and future identification methodology such as visual ID, tags, ISO RFID devices of all types, DNA, retinal scan, brands, metal tags, tattoos, ear notches and any other official or commercial production identifiers. The importance of this flexibility and completeness of identification may become critical to an accurate traceback as well as defending producers against inaccurate or false claims, quarantines or movement / sale restriction.

Specific modifications are as follows:

Page 17 III.D Identification Devices - First Paragraph

Change "…electronically encoded in the chip."

To: "…electronically encodes in the chip or a current identification process that is associated with the official ID number in a database."

Change: "…both utilizing eartag devices to attach the US Animal Identification Number to the animal."

To: " …both utilizing eartag devices to attach the US Animal Identification Number to the animal or to attach current tagging devices to the animal which will be associated with the official ID number in a database."

Page 17 III.D Identification Devices - Second Paragraph

Change: "Required visible information printed will be the official US logo and the complete official number."

To: "Required visible information printed will be the official US logo and the complete official number (UAIN number or the preferred option of an unique official DAINVI) or a current identification process that is associated with the official ID number in a database. "

Page 19 IIID2. Radio Frequency Identification, Performance and Devices Standards

Change: “Transponders are to be encoded with the US country code (840).”

To: “Transponders are to be encoded with the US country code (840) or use existing transponders in the supply chain.”

Change: “The required visible US logo and the AIN will be printed on the transponder portion of the tag.”

To: “The required visible US logo and the AIN will be printed on the transponder portion of the tag or use existing transponders in the supply chain.”

Change: “The official height and width of the official logo is to be 5mm.”

To: “The official height and width of the official logo is to be 5mm, with the exception of using existing RFID tags in the supply chain that do not require the official logo.”

Change: “The printing and tag color contrast of the official logo, lettering…”

To: “If applicable, the printing and tag color contrast of the official logo, lettering…”

Change: “Only approved devices for use in the National Identification System will use the US logo.”

To: “Only approved devices for use in the National Identification System may use the US logo.”

Page 23-24 IV.B. Animal System, Brief USAIN Administration and ID Tag Distribution Flow Chart

Number 5:

Change: “If the US Premises ID Number is correct, the USAIN Manager provides the official identification devices to the producer/premises.”

To: “If the US Premises ID Number is correct, the USAIN Manager provides the official identification devices or the official UAIN number to the producer/premises.”

Number 6:

Change: “The USAIN Manager reports the USAINs to the ID DB that were printed or encoded on the…the tags are purchased.”

To: “The USAIN Manager reports to UAINs to the ID DB that were printed or encoded on the…the tags are purchased. In the case of using an existing tagging processes the UAINs are just reported to the ID DB.”

Page 29 V.A.3 Animal Tracking

Change: Paragraph one, all references dealing with “USAIN Tags”

To: “UAINs”

Page 31 V.B.1 Cattle

Change: “…US Animal Identification Number (USAIN) versus a tag…”

To: …US Animal Identification Number (USAIN) or use of an existing tagging system associated with an UAIN in the database versus a tag…"

Page 43 VI.E.1 Cattle

Change: Paragraph One, "…with a lifetime number that can be printed on a visual tag, encoded on an RFID transponder or a combination of both."

To: "…with a lifetime number that can be printed on a visual tag, encoded on an RFID transponder or use current identification process that is associated with the official ID number in a database. A combination of the three methods is preferred."

Page 44 VI.E.1 Cattle

Certified USAIN Managers

Change: Paragraph One, "USAIN identification devices will be distributed through USAIN Mangers who will be approved…"

To : "USAIN identification devices or UAIN numbers will be distributed through USAIN Mangers who will be approved…"

Requirements for a Certified USAIN Manager

Change Bullet three: "…(SKU number) that each number was imprinted on and/or encoded, in particular if the device was electronic (RFID) and/or visual."

To: "…(SKU number) that each number was imprinted on and/or encoded or if the official number was issued to be used with an existing tagging process, it also needs to be stored in the database."

Change Bullet four: "…encoded on officially approved devices."

To: "…encoded on officially approved devices or used in a database as a universal ID with an existing tagging process."

Requirements for a Certified USAIN Manager

Change Bullet five: "Furnish official identification devices to producers…"

To: "Furnish official identification devices or UAIN numbers for use with existing tagging processes to producers…"

Page 44 VI.E. 2

Change: "is attached to the animal's ear with a tamper resistant eartag (one time use)"

To: "is attached to the animal's ear with a tamper-resistant eartag whether it be a single or multiple use tag to allow for the use of existing tagging processes currently in place"

Page 45 VI.E. 2

Change: "…the American identification Number is imprinted on a tamper resistant eartag (one time use)"

To: "…the unique official visual tag number (DAINVI) or a multitude of alternate devices which are associated to a UAIN in a TC database and the national cross-reference database."

Page 45 VI. E. 3. Phase out of existing official numbering systems, line three

Change: "USAIN"

To: "UAIN"

Page 45 VI. F. Official Identification Devices

Change Paragraph One: "USDA/APHIS will promulgate…the USAIN or premises number system."

To: "USDA/APHIS will promulgate…the USAIN or premises number system. In addition, allow the use of current identification/tagging processes that is associated with the official ID number (UAIN) in a database."

Change Paragraph Two: "The USAIN and the U.S. logo will be imprinted on an official identification devices."

To: "The USAIN and the U.S. logo may be imprinted on an official identification and existing identification devices depending of the types of approved devices used in the animal tracking and traceback process."

8. Appendix F – UAIN White Paper Supplement

An Industry, Federal and State partnership is working together to develop a United States Animal ID Plan (USAIP) that can be effectively implemented to provide for a 48 hour trace back program for foreign animal disease prevention, containment and eradication. As part of an October, 2003 USAHA Meeting held in San Diego, CA a resolution was passed that transferred further development of the Plan to specie specific associations and their working groups. In addition the USAIP has been posted and made available for public comments.

Therefore, regarding the implementation of the plan for the beef industry, the following are recognized as fundamental changes that must be incorporated into the USAIP as requirements for effective implementation.

The USAIP must require that each individual animal possesses, in a database, a unique universal identification number that is stored as the permanent official ID but that is not required to be affixed to the animal.

The USAIP states, and so it is understood by beef industry members, that the implementation must make use of existing tagging systems during a transition period. Moreover, a December 4, 2003 announcement posted by the USAIP on their website reinforces this requirement by stating, "Currently, USAIP working groups are being formed to provide needed detail to the Plan including but not limited to... how current identification systems may be integrated into the Plan."

To enable the Plans requirements an animal must be identified with an official number allocated to that animal by the government. Fundamentally it is understood that this identification number must be unique, permanent and tamper proof. In order for the identification to meet those requirements the ID can only be secure if stored in a database. Once stored in a database, all currently available and future forms of tagging devices on the animal may then be associated to the permanent ID for that animal in the database. The permanent database ID is referred to as the Universal Animal Identification Number (UAIN). The UAIN is synonymous to the USAIN referred to in the Plan however; the difference is that the UAIN is not required nor does it assume that it be affixed to the animal. The reason is that no ID attached to the animal is permanent or tamper proof and most importantly the Plan requires the aforementioned use of existing tagging systems that in and of itself precludes the use of an official ID on the animal. So, to accommodate these stated requirements the Plan and its implementers cannot order the enforcement of an official device on the animal during a transition period nor can databases assume, expect or require that any type of "Official" ID (USAIN) will be on the animal. To do so creates an implementation failure from the outset. Moreover, the current use of a permanent database Universal ID is a norm among leading software companies and can be easily and effectively implemented by Data Service Providers.

The logic of these requirements is sound because as one considers performing the 48-hour traceback process one recognizes that it will be a database procedure. The database is where officials will enter the animal's current premises and visual ID and source the essential information.

A further requirement that must be included in the Plan is that all necessary components required for compliance purposes, including but not limited to identification numbers and devices of all types, must be freely available.

Terminology in the Plan should be modified to include changing the AIN or USAIN to UAIN. This change must reflect that the UAIN is stored in the database and not required to be affixed to the animal. All additional IDs are referred to as a DAIN or Device Animal Identification Number, which is affixed to the animal and associated to the UAIN in a database.

An additional benefit of these clarifications is that the industry during the implementation and transition phase is not forced to change its ID systems or the way it sources its identification systems and tag manufacturers are not required to change their methods of producing and distributing tags. It is also recognized that these changes allow the free enterprise system to choose which ID method(s) is ultimately used.

In summary, the following represent the only officially allocated numbers to be used in complying with the USAIP and the administrator of such numbers.

UAIN – A unique and official number assigned to an animal, allocated by the government and stored in database to enable the traceback process.

DAIN RFID – A unique numbering scheme allocated to RFID manufacturers and overseen by ISO.

DAIN VID – A unique official visual ID number allocated by the government to AIN Managers or DSPs.

Premises ID – A unique premises identification number allocated by the government.

Alternate ID – A non-official current identification method used by the beef industry.

9. Appendix G - Creating a National Visual Tag (DAINVI) to Complement the UAIN

The government needs to issue unique visual tag numbers (DAINVI) to tag manufacturers for tag production. This number is different from but still unique and linked to the UAIN number in the database when assigned to an animal by an event. This DAINVI may be used separately or used in conjunction with a DAINRF for identifying an animal. These low cost DAINVIs will be freely available in the market place and when purchased and applied to an animal will then be linked to the UAIN assigned by the government and linked to any other device on the animal.

Recommendation

It is recommended that the government issue a separate unique identification number for official visual tags to manufacturers that is a different unique number from the UAIN that is permanently assigned to animals in the database. These numbers will be controlled between the tag manufacture and the government to ensure uniqueness and may contain an official logo. This tag will complement the use of ISO RFIDs (DAINRF)and existing tagging/identification processes currently in place today. These will contain the unique number at the bottom to allow for hot stamping at customer locations for operational purposes or printed by the manufacturer to utilize an existing numbering system.

10. Appendix H - DAIN/UAIN Cross-Reference Database

Since the UAIN may not be physically attached to an animal or it may have been attached to the animal and is now lost or unreadable, we must have a database service available that allows for the linking of any DAIN to the UAIN between Data Trustee (DT) networks. When an animal moves from one premises to another, this information must exist in a database that is readily available to the receiver or the receivers DT. The UAIN information will be included in official animal transfer documents in order to facilitate quick trace back. The data should be available electronically. If the animal is moved from one premises to another within the same DT network, this database is a natural function of the DT. When the animal is moved from one premises to another outside the DT network, the database most likely should reside in a central database used by multiple DTs. The majority of the industry does not want this cross-reference database maintained by the government.

Recommendation:

Create a national cross-reference database for the linking of all DAINs to a UAIN for a specific animal to facilitate the tracking of animals while using existing and proposed identification tagging systems in a distributed architecture.

11. Appendix I - Privacy Concerns in a National Animal ID Program

The USAIP proposes a national database that serves as the foundation for a system that provides 48-hour traceback to any premises, and all animals that have been exposed to an animal with a Foreign Animal Disease (FAD). While there can be no doubt as to the value of such a system in helping to maintain the health and economic viability of U.S. animal agriculture, the fact that the system will be capturing data that many in the industry may consider as private (i.e. of a personal or commercial nature), and the fact that the current document makes no effort to address privacy issues, may cause this effort to meet with a great deal of resistance.

Data, today, is treated as a valuable asset by both private companies and public institutions that can be used for fact based decision-making. Unfortunately for privacy concerns, it is also possible to use this data for analysis by means of data mining tools for automatic exploration and pattern discovery. In addition, it is inevitable that where large databases of information are available, whether the information is of a private nature, or not, officials and others think up new uses for the data.

Privacy Issues

The following are general privacy issues related to the misuse, or misapplication of private data:

Secondary Use of Personal Information

Surveys have shown a great concern about the use of personal data for purposes other than the one for which the data has been collected. Most individuals consider the use of information for secondary analysis a direct invasion of privacy.

Handling Misinformation

Misinformation can cause serious and long-term damage, so individuals should be able to challenge the correctness of data about themselves.

Granulated Access to Personal Information

The access to personal data should be on a need-to-know basis, and limited to relevant information only.

New Privacy Threats

With the advent of data mining tools it has become very easy to use general patterns for guessing confidential properties. It has been determined that combining two or more general patterns may lead to disclosure of individual information, either with certainty, or with a high probability. Also, knowledge of totals and other similar facts about the data may be correlated to facilitate compromising individual values.

Possible Solutions

Any solution to the problem of privacy will necessarily be a mixture of technology and policies. As such, we first present an overview of current privacy regulations and guidelines, followed by eight principles for responsibly managing private information, and finally some technical solutions that can be used to help protect private information.

Privacy Regulations and Guidelines

The U.S. Privacy Act of 1974 gives thorough guidelines for limiting the collection, use, and dissemination of personal information by the Federal government. The act stipulates that Federal agencies must:

- Permit an individual to determine what records pertaining to him are collected, maintained, used, or disseminated
- Permit an individual to prevent records pertaining to him obtained for a particular purpose from being used or made available for another purpose without his consent
- Permit an individual to gain access to information pertaining to him in records, and to correct or amend such records

- Collect, maintain, use or disseminate any record of personally identifiable information in a manner that assures such action is for a necessary and lawful purpose, that the information is current and accurate for its intended purpose, and that adequate safeguards are provided to prevent misuse of such information
- Permit exemptions from the requirements with respect to the records provided in this Act only in those cases where there is an important public policy need for such exemption as has been determined by specific statutory authority
- Be subject to civil suit for any damages that occur as a result of willful or intentional action that violates any individual's right under this Act.

These concepts have led to what are known as "Fair Information Practices", and have been incorporated into important international guidelines for privacy protection. The most well known of these were developed by the Organisation for Economic Cooperation and Development (OECD) which put forth the following principles for data protection: collection limitation, data quality, purpose specification, use limitation, security safeguards, openness, individual participation, and accountability.

Eight Principles for Data Protection

Based on the previously described guidelines and regulations, we now describe a set of principles that we believe should be addressed by any system that purports to responsibly manage private information. They also serve as a statement as to what a data donor can expect from the system. They are as follows:

- **Purpose Specification**: For personal information stored in the database, the purpose for which the information has been collected should be associated with that information.
- **Limited Collection**: The personal information collected should be limited to the minimum necessary for accomplishing the specified purposes.
- **Limited Use**: The database should run only those queries that are consistent with the purposes for which the information has been collected.
- **Limited Disclosure**: The personal information stored in the database should not be communicated outside the database for purposes other than those for which there is consent from the donor of the information.
- **Accuracy**: Personal information stored in the database should be accurate and up-to-date.
- **Safety**: security safeguards against theft and other misappropriations should protect personal information.
- **Openness**: A donor should be able to access all information about the donor stored in the database.
- **Compliance**: A donor should be able to verify compliance with the above principles. Similarly, the database should be able to address a challenge concerning compliance.

Technical Solutions

The primary goal of a database system is to provide an environment that is both convenient and efficient to use in retrieving and storing information. Given the design goals of current database systems, it is not surprising that they fall short in providing for privacy concerns. Nonetheless, there are some techniques that could be applied to a national animal ID database that would help to address these concerns:

Query Restriction and Data Perturbation

Query restriction includes restricting the size of query results, controlling the overlap among successive queries, keeping audit trails of all answered queries and constantly checking for possible compromises, suppression of data cells of small size, and clustering entities into mutually exclusive atomic populations.

Data perturbation includes swapping values between records, replacing the original database by a sample from the same distribution, adding "noise" to the values in the database, adding "noise" to the results of a query, and sampling the result of a query.

Secure Databases (Public/Private Data)

Whenever sensitive information is exchanged, it must be transmitted over a secure channel and stored securely to prevent unauthorized access. As there is extensive literature related to access control and encryption, we won't go into further detail here.

However, there are particular aspects of database security that should be of interest in a national animal ID database, particularly the ideas on multilevel relations in the context of multilevel secure databases. Simply put, multiple levels of security are defined (e.g. top secret, secret, confidential, unclassified) and associated with individual data items. The security level of a query may be higher or lower than that of individual data items. A query with a lower level of security cannot read a data item with a higher security attribute. On the other hand, a higher security query cannot write a data item with lower security. Two queries having different levels of security can therefore generate different results.

This idea can be abstracted further to the point where there are only two security levels: unclassified and classified, or public and private. For the purposes of this discussion one can think of public and private data as:

- Public Data – data that deals exclusively with the state, condition, description, and care of the individual animal.
- Private Data – data that links to animal owners, handlers, location, or cost.

A very simple means of protecting private data would be to encrypt the data fields flagged as private prior to placing them into the database using a public key encryption methodology. This has the desired effect of "hiding" the data until such time as it is needed. Should the data be needed during a suspected FAD, it can be decrypted prior to running a report.

Decryption of the data would be controlled by who has access to the key. Using a "nuclear silo" analogy, one could split the key into pieces between two or more responsible parties, such that the data could not be decrypted unless all parties agreed, and made available their piece in order to create the whole key.

"Need-to-Know" Access

Another technique for maintaining privacy is to store information such that it is distributed among a number of different locations. When the data are needed they can be retrieved from these distributed systems. Thus, no one system has a complete picture of the information pertaining to a given individual. Please see the Beef Information Exchange (BIE) white paper "USAIP Architecture - Centralized "Push" or JIT Decentralized "Pull"?" for a more in depth discussion.

Conclusion

Technology alone cannot address all of the concerns surrounding a complex issue like privacy. The total solution must be a mixture of laws, societal norms, markets, and technology. Therefore, the BIE recommends that the national animal ID database has 1) clearly stated principles similar to the eight principles outlined above, for the collection, and use of information, and 2) that some combination of the technologies discussed, e.g. public/private data and a JIT data access methodology be adopted. Only by effectively managing private information can the USAIP hope to gain the support and trust of the industry, thus mitigating the resistance that may otherwise be encountered.

References:

http://www.usdoj.gov/foia/privstat.htm

http://www.oecd.org

12. Appendix J - Public/Private Data in a National Animal Identification Program

The historical antagonism that has existed between segments of the beef industry has resulted in a lack of trust between them, and an unwillingness to share certain types of information. The potential for abuse in a system where everyone has access to all data is great, and will undoubtedly meet with resistance from those who do not want their competitors to have access to their data. For example, by having access to all of the location data about an animal, or group of animals, it might be possible for a buyer in one segment to simply "go around" a supplier that he would normally buy from, and go direct to the supplier's supplier. In addition, there may be resistance to a third party such as the U.S. government to be able to "mine" this data.

Public/Private Data

Central to any system that needs to maintain the anonymity of certain data is the idea of public and private data. For purposes of discussion we will use the following definitions:

Public Data – data that deals exclusively with the state, condition, description, and care of the individual animal.

Private Data – data that links to animal owners, handlers, location, or cost.

As the currently proposed system treats all data as public, i.e. available to all, and is a fairly unambiguous idea, we will be limiting the remainder of our discussion to the use and implementation of private data in the proposed national system.

Private Data

Since the goal of the USAIP system is:

"To achieve a traceback system that can identify all animals and premises potentially exposed to an animal with a Foreign Animal Disease (FAD) within 48 hours of discovery"[i]

a method is needed to decouple the data deemed to be private, from the data that can uniquely associate an individual with it, yet still permit traceback in the event of a FAD.

Access Control

There are a number of different access control methodologies, but one that is often used to manage private data is known as Content-Based Access Control (CBAC). CBAC simply denies access to any private data item to all but a specific privileged account. While CBAC will not permit non-privileged accounts access to private data, it does nothing to prevent "data mining" since all of the data is essentially visible to the privileged account. Unfortunately, all forms of access control suffer from this problem.

Encryption

A very simple means of protecting private data would be to encrypt the data fields flagged as private prior to placing them into the database using a public key encryption methodology. This has the desired effect of "hiding" the data until such time as it is needed. Should the data be needed during a suspected FAD, it can be decrypted prior to running a report.

Decryption of the data would be controlled by who has access to the key. Using a "nuclear silo" analogy, one could split the key into pieces between two or more responsible parties, such that the data could not be decrypted unless all parties agreed, and made available their piece in order to create the whole key.

One drawback to this scenario is the case where someone is aware of a transaction taking place and uses this knowledge to search the database for transactions that have similar characteristics. Once the likely transactions have been found it may be possible to deduce the private data. Simply broadening our definition of private data such that any distinguishing characteristics are also hidden can mitigate this problem. Another possibility would be to change the encryption method, or key, at a regular interval to lessen this possibility.

There may be some concern that encryption adds additional overhead to the system, but considering that FAD's are not daily occurrences, and that the target turn around is 48 hours, it is doubtful that having to decrypt certain data fields prior to their use in reporting will impose much of a burden on the system.

One final benefit of encryption would be to make "data mining" virtually impossible. This of course requires that appropriate control is maintained of whom, and when, data may be decrypted.

13. Appendix K - Inconsistencies Between Animal Event Codes and Animal Transaction Record Format

Version 4.0 of the USAIP identifies fourteen animal event codes on page 55 of the document. The event code is a two-character field appearing as field number 1 in the individual animal transaction record and the group/lot movement record.

For many of the fourteen event codes the remaining 17 fixed format data fields for the animal are highly appropriate, and no change is required. However, beginning with animal event code 7 we believe that this event code and subsequent event codes do not provide sufficient information to support the event. It may be the intent to use the 50 characters of the remarks field (field #13) to provide this information, and, if so, a pre-formatted, event-specific data field format should be utilized within these 50 characters for each event so that the data can be reliably parsed.

If the 50-character remarks field is allowed to be a "free-format" field, there is the high likelihood that different organizations submitting data will format this field very differently. Having idiosyncratic coding will substantially hinder the system's overall purpose of rapidly responding to animal health threats because the idiosyncratic use of the remarks field would require human intervention rather than allow the computers to effectively parse data. For example, if the remarks column were used to store the country of origin for an importation event, and if there was no pre-formatting of how this country data would be encoded (both which positions or how a country would be represented), then one data supplier might indicated a Mexican origin by putting "MEX" in column 1 of this field, while another might put "From Mexico" in column 1, and a third might just put "M" in some other column.

The following event codes are a sample of the type of information that appear to be missing:

- Event 7 (Animal importation) - This event requires identifying the source premises and the destination premises. Currently, only one data field (field #3 – source/data premises ID) is provided to support this event and that is insufficient to record both the premises exporting the animal and the premises receiving the animal. At least one more premises identification data field needs to be added. And even if data field # 3 is being used for either the sender or the receiver, the current premises identification record for identifying premises is insufficient.
- Event 8 (Animal exportation) – Requires the same adjustment as event #7.
- Event 9 (Animal sighting) – Requires some level of consistent coding for the type and result of the animal sighting. If these data are random, free form comments, they will not necessarily be easily processed, analyzed and compared.

A second issue with event codes is that they appear to be designed for individual animal movement as opposed to the group/lot movement record format (ID #2). One specific deficiency is that the group/lot movement record format does not indicate the number of the animals in the group. Another is that there are no events that can be used to either add or subtract animals from a given lot.

A final issue is the actual record structure used to report animal transactions. The record structure for the remaining 18 designated data fields is a fixed format structure, with approximately one-third of this total being allocated for a free-form remarks column that has been previously discussed. A fixed format transaction record structure was the industry standard for the early-computerized age, and remains a frequently chosen structure. However, there are more modern, variable formats for data transfer available today such as XML and its variants (reference the BIE white paper recommendation regarding XML). While there is a concern to allow older, legacy software to send data to the national system, basing communication structures on an older data approach could potentially hamstring potential future growth and expansion.

Recommendation

BIE recommends that the USAIP work plan be modified to either adopt a more flexible record communication format such as XML (strongly preferred), or pre-format the fifty character remarks data field (data field #13) to be specific to each event type. While either path would solve the problems identified in this paper, the BIE strongly is in favor of expressing the transaction record format as an extensible XML record. Accommodation of this XML recommendation with legacy systems could be handled via a small piece of "middleware" software that would translate the XML code to the legacy record structure. Such coding will be required by legacy systems even to accommodate the recommended fixed record structure.

The second recommendation is that the data sub-fields required to support each event code be identified, and either tags for these sub-fields be identified (for an XML solution) or the fifty character remarks field be pre-formatted to accommodate storage of this information (pre-formatted field structure).

The third recommendation is that the group/lot movement record format indicates the number of animals in the group/lot, and that events be added to the event structure, which allow for movement of animals into and out of groups.

14. Appendix L - Event Data Transmission Using XML

Extensible markup language (XML) is rapidly becoming the standard data exchange file format. It rivals older standards today and Microsoft's use of it in its Office 2003 productivity suite promises to make XML pervasive in the future. The ability to transparently transfer animal movement data between computerized databases is vital in expediting animal trace back.

Sample XML

Sample XML files have been constructed to reflect the file layouts described in the current USAIP work plan. The XML formats cannot be finalized until the USAIP database schema is finalized.

File Size Issues

It is commonly thought that, because of the use of field tags, XML data files take more space than fixed-length data files. But it is the use of field tags that allow XML data fields to be of variable length, taking only the space needed to hold the data.

For example, a data field that is designed to hold 50 characters in a fixed format will take 50 characters even if the data to be transmitted needs much less space. Even though the transaction takes 10 bytes less to express in XML, the data is now self-describing, open, and concise. In addition, XML lends itself to data element modifications more easily than fixed-format.

While it is true that XML does consume more space for small data elements, the point here is that the space usage issue should not be given too much weight given modern data transmission, compression, and storage technology.

References:

http://www.xml.org

http://www.microsoft.com/office/editions/prodinfo/technologies/xml.mspx

15. Appendix M - Error Detection in Transmitted Data Files Using a Cyclic Redundancy Check Checksum

The USAIP has provisions for data validation and error correction of the Premises, Animal, and Lot ID records, however, there is no provision for ensuring the integrity of the transmitted data file. In all likelihood any national system will need to accommodate the transmission of data files using a variety of protocols depending on the capabilities and level of sophistication of the sender. Different protocols have varying levels of reliability with regard to the sent and received data. In addition, the possibility of malicious individuals trying to corrupt the system cannot be ruled out. A means of determining whether the received data file has been modified unexpectedly, whether by hardware failure, software failure, or malicious tampering, would provide an additional method to help ensure the accuracy of the data.

Error Detection

The purpose of an error detection technique is to permit the receiver of a message to determine whether the message has been corrupted. To accomplish this, the sender calculates a value known as a checksum[ii] that is a function of the data being sent. The sender then sends the data and its checksum to the receiver. The receiver of the data then uses the same function to determine if the data were received correctly. A typical checksum function might simply sum each byte of data and perform integer division by 256 on the final sum. For example (all numbers are decimal):

Original Data	: H I T	(72 73 84)
Data with Checksum	: H I T s	(72 73 84 229)
Data after Transmission	: H O T s	(72 79 84 229)

In this example, the second character is changed from an I (73) to an O (79) during transmission. The receiver can detect this error by comparing its calculated checksum (235) to the received checksum included with the data (229). If the checksum is corrupted during transmission, correct data may be incorrectly identified as bad, but this particular failure does no harm and simply requires retransmission of the data. A more dangerous failure occurs when the data and/or checksum are corrupted in such a way that the transmitted data remain internally consistent. Unfortunately, there is no way to avoid this type of failure. The best that one could hope for is to minimize the probability by using a checksum larger than one byte.

Improving the Checksum

As demonstrated by the example in the previous section it is fairly easy to detect minor data corruption using an algorithm that calculates a checksum by summing the bytes modulo 256. The main problem with this algorithm is that it is too simple. If more than one corruption occurs in the data there is a 1/256 chance that the errors will go undetected. For example:

Original Data	: H I T	(72 73 84)
Data with Checksum	: H I T s	(72 73 84 229)
Data after Transmission	: L E T s	(76 69 84 229)

In order to improve upon this checksum algorithm we could increase the number of bytes used to store the sum from one to two, thus reducing our failure probability from 1/256 to 1/65536. Unfortunately, while this solution appears to be adequate on its surface, in reality it will still fail in this particular example. The simple summing strategy is not sufficiently random because each incoming byte can only affect about one byte of the sum. Therefore, for this example, the technique will fail regardless of the number of bytes used to store the sum. This problem can only be solved by using a more sophisticated algorithm that permits every incoming byte to affect all bits of the checksum.

Cyclic Redundancy Check (CRC)

From the examples in the previous sections, it is clear that addition is not nearly strong enough for generating effective checksums. However, it turns out that division works well providing that the divisor is about as wide as the number of bytes used for the checksum. The basic idea behind all CRC algorithms is to treat the incoming data as one giant binary number, divide it by another fixed binary number, and use the remainder as the checksum. The details of how CRC algorithms work have been discussed in many publications by others, so we will not go into depth on how to calculate CRC's in this white paper.

CRC-32

CRC-32 generally refers to a specific 32-bit CRC algorithm defined by the ***C**omité **C**onsultatif **I**nternational **T**éléphonique et **T**élégraphique* (CCITT) an organization that sets international communication standards.

The CRC is calculated using polynomial division. A block of data, or "message", is treated as if each bit in the block were the coefficient of a long polynomial. For example, the hexadecimal value F8 would correspond to the polynomial:

$$1 * X^7 + 1 * X^6 + 1 * X^5 + 1 * X^4 + 1 * X^3 + 0 * X^2 + 0 * X^1 + 0 * X^0$$

Since the zero terms drop out we are left with:

$$1 * X^7 + 1 * X^6 + 1 * X^5 + 1 * X^4 + 1 * X^3$$

While it may appear that calculating the CRC of a large message, e.g. a data file, would cause a problem due to the very large values of the exponents that would be produced, this is not in fact a problem. The exponents are not used in the calculation of the CRC so they may grow unconstrained by an upper bound.

As mentioned briefly in the previous section, the calculation of the CRC is performed by dividing a second polynomial, the generator polynomial, into the polynomial representing the message resulting in a quotient and a remainder. The CRC-32 algorithm uses the following generator polynomial:

$$X^{32} + X^{26} + X^{23} + X^{22} + X^{16} + X^{12} + X^{11} + X^{10} + X^8 + X^7 + X^5 + X^4 + X^2 + X^1 + 1$$

After dividing the generator polynomial into the message polynomial and obtaining a quotient and remainder, the quotient is discarded and the remainder becomes the checksum.

CRC-32 for File Verification

While CRC-32 was originally created by the CCITT for use in telecommunications, there is nothing intrinsic to the algorithm that would make its use unsuitable for detecting unexpected modifications to a file. Using the CRC-32 algorithm to generate a 32-bit number for a file would permit the creation of a "fingerprint" for that file. This fingerprint would provide for a probability of failure of $1/2^{32}$ (1/ 4,294,967,296). In addition, there are a several more characteristics that make the CRC-32 very attractive for verifying files:

- Every bit in the message contributes to the CRC. This means that changing any bit in the message should change the CRC.
- Relatively small changes in the message should always result in changes in the CRC. We want to be sure that it would take an extremely unlikely combination of errors to produce an identical CRC.
- The histogram of output CRC values for input messages should tend to be flat. For a given input message, we want the probability of a given CRC being produced to be nearly equal across the entire range of possible CRC's from 0 to FFFFFFFF hexadecimal (0 to 4,294,967,296 decimal).

These characteristics should give us great confidence that the chance of damaging or modifying a file without modifying its CRC is exceedingly small.

Conclusion

Due to the possibility of unexpected modification of the USAIP data files, whether inadvertently during transmission or by a malicious act, a method is needed to ensure the integrity of these files. The current draft document provides for limited error handling with regard to the data contained in the Premises, Animal and Lot ID records, but there is no provision for ensuring that the data received was the data that was actually sent. We recommend the incorporation of a simple CRC-32 checksum into the USAIP data file header to provide a highly reliable, low overhead method to ensure that no unexpected modification of those files has occurred, and that the received data is in fact what was sent.

16. Appendix N - Species Record Element Needs to be Required Field

The USAIP indicates in the record layout for the individual animal transaction record that the field 7, which has been allocated to record “species”, is not a required field.

Given that a single premises will possibly have a mixture of species, given that certain diseases may cross species barriers, and given that the USAIP has been given to the species groups for final implementation, it makes good sense for this field to become a required field.

Recommendation

Field 7 (“species”) be changed to a required field.

17. Appendix O - Foreign Animal Traceback

The USAIP does not make any specific reference to the process in which foreign animals will be controlled and monitored in the United States or reference any preexisting policies governing this process.

Recommendation

Review criteria required on the importation of foreign animals for incorporation into the USAIP:

- Country of origin
- Premises within the foreign country, if applicable
- Border station should record the port number as the move-in transaction. The move-out transaction should contain the destination premises or carrier trailer number

Reference Appendix K for event code 7 on animal importation.

18. Appendix P - CRUD Analysis on the Proposed USAIP Database

The USAIP includes guidelines for the creation of a national database designed to store individual animal movement and sighting records. The plan outlines the process by which state systems, service providers, and even producers themselves can upload individual animal transaction records to the national database. This process outlines what can only be described as a "push" system – meaning that data is "pushed" to the national system by state systems, service providers, and producers whenever the data is available. Data records, which have been pushed to the national database, cannot be touched again once they have been processed and entered into the national database. These records simply accumulate in the database. There is no means by which erroneous records can be updated or deleted. In order to correct an erroneous record, a new record must be uploaded with corrected data. The incorrect record would remain on the system, but would essentially be "buried" under the newer, corrected record.

Also, in the current USAIP there is no interface for retrieving data from the database in the event of a disease outbreak and/or a traceback situation. Furthermore, there is no mechanism for feedback to those supplying data to the system, and this deficiency needs to be corrected. Producers and/or processors should have the ability to check the accuracy of inventory in the system currently assigned to them. Neglecting this review function creates potential problems for the national ID database to be "out of synch" with reality, and could promote a sense of unease in producers and processors with respect to the national ID program.

Recommendation

BIE believes that the USAIP national animal ID database design guidelines should be expanded to allow for the creation of a much more robust and functional database. Guidelines and procedures should be created to allow incorrect records to be updated and/or deleted if necessary. This will reduce ambiguity in the dataset that a USDA/APHIS official will have to utilize in the event of a traceback situation by eliminating incorrect data. This will also increase the efficiency of the query and analysis by enabling the official to look at only correct data instead of first trying to determine which records are correct and which ones might not be correct before performing an analysis of the data.

BIE also recommends that the USAIP work plan be modified to allow a producer or processor to request a report showing their current inventory as seen by the system. Having this function would allow producers and processors to correct any potential database errors by initiating potentially omitted transfer events.

In the event that the "pull" database model is adopted, this request for the current inventory would become the responsibility of the trusted data collector with which the producer or processor is currently working.

Access to this "inventory report" should be granted (via the internet) to a user who logs in with a unique premises number and a corresponding password. This password would have to be generated by either the USDA/APHIS Premises Allocator (in the case of the "push" model) or by the trusted data collector (in the case of the "pull" model).

In summary, BIE would like to see the database design guidelines currently outlined in the USAIP modified to allow more functionality to a broader array of end users. At minimum, the database must be modified to allow end users to have the ability to perform the essential functions of reading, updating, and deleting data records where necessary.

19. Appendix Q - USAIP Needs to Be More than a Write-Only System

As proposed, the USAIP system is a "write-only" database with respect to producers and processors who are entering data, and there is no mechanism for a producer or processor to check the accuracy of inventory in the system currently assigned to them. Neglecting this review function creates potential problems for the national ID database to be "out of synch" with reality, and could promote a sense of unease in producers and processors with respect to the national ID program.

Recommendation

The BIE recommends that the USAIP work plan be modified to allow a producer or processor to request a report showing their current inventory as seen by the system. Having this function would allow producers and processors to correct any potential database errors by initiating potentially omitted transfer events.

In the event that the "pull" database model is adopted, the Data Trustee with which the producer or processor currently is using would handle this request for the current inventory.

20. Appendix R - Data Security

The current USAIP document gives a very broad and general description of the proposed security measures of the National Animal ID Database Application. Security across the multiple layers of the application plays an important role in the ultimate success of this system. To date the specific security layers and needs of this application have not been thoroughly explored or identified and no protocols or procedures have been developed to support these needs. The following is a list of key security issues that should be addressed and documented:

Hardware/Software

- Physical Security (Facility Security Measures)
- Network Security
- Firewalls
- Load Balancing
- Redundancy
- Backup/Off Site Storage
- Disaster Recovery

Users

- Administration and Management of User Names and Passwords
- User Roles
- User Level of Access
- User Validation
- Session State

Data

- Data Encryption
- Use of Secure Socket Layer (SSL)

Recommendations

Security is a curtail element to the success of the proposed system. The Beef Information Exchange recommends that a special task force be put together to design and develop the specific security protocols and procedures needed for the National Animal Identification Database Application.

21. Appendix S - Chain of Custody Concept

Many companies have realized that to ensure the integrity of transaction processing systems that a formalized set of checks and balances need to be implemented into the design and operation of the system. The concept of transaction Chain Of Custody deals with the verification that a receipt of the movement transaction at the destination location has been performed within a specified time period. In addition, a reconciliation process needs to be developed to resolve discrepancies with the transaction exchanges.

This concept is focusing on the following events as defined by the USAIP plan:

- Move Out Transactions
  - Animal Transaction Record File ID #1
    - Event 4 – Moved out – Animal is moved out of a premises
    - Event 10 – Slaughtered – Animal was sent to slaughter
  - Group/Lot Movement Record File ID #2
    - Event 3 – Moved Group/Lot out of a premises
- Move In (Receipt) Transactions
  - Animal Transaction Record File ID #1
    - Event 3 - Moved in – Animal is moved into a premises
    - Event 12 – Tag retired – Mainly by a packing house
  - Group/Lot Movement Record File ID #2
    - Event 2 – Moved Group/Lot into a premises

When a move out transaction from one premises to another has been initiated then a corresponding move in (receipt) transaction needs to acknowledge that the animals actually arrived at a valid premises within a specified time period. This chain of custody concept is commonly called a double entry process similar to the credit/debit entries used in general accounting principals to ensure the integrity of transactions.

If this type of concept is not adopted then animal movements that are in transit and do not have a receipt confirmation back to either a centralized or distributed database will not be accounted for during an specific timeframe which could be months. The in transit movements must be reconciled within a set time period to ensure the 48 hour traceback is obtainable.

In the current USAIP plan, the Source/Destination Premises ID field is not required for a valid transaction, which can lead to major problems in the integrity of a true traceback process. The destination premises ID must be required on all Moved Out transactions. The source premises ID on Moved In transactions does not pose as great of a risk in providing accurate data in the event that a traceback is initiated because this is simply an acknowledgement of receipt at a valid premises ID. In most cases every premises custodian should know exactly where they are authorizing a movement of animals to go and should be provided the capability to obtain the destination premises ID prior to movement. Whether that is via an online system or a simple phone call to the destination premises custodian.

One scenario that could happen to invalidate the traceback process within the guidelines of the current USAIP would be that animals are moved from a production site to a valid market site with the appropriate move out transaction submitted which did not contain the destination premises ID (Market site). The animals are bought by another valid production site at the Market that same day and delivered to the new production site. At this time a move in transaction is initiated from the new production site premises location without a source destination (Market site). The animals are accounted for but there will never be any reference point in the database to indicate the animals were ever at the market site premises ID. Without having a true chain of custody process for animal movements to and from valid premises IDs will greatly inhibit the ability to perform a valid traceback.

Centralized Database Concept for Chain of Custody

Assumptions:

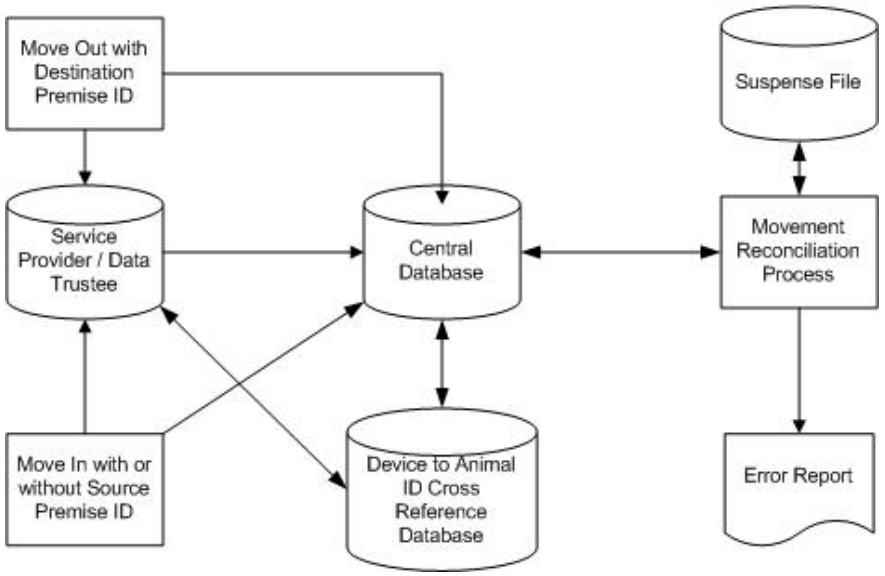
- One single centralized database for the national ID program

Sequence of Events for the following diagram:

- Move out and Move in transactions can be sent to the central database via a Service Provider/Data Trustee or directly to the central database from the source
- The central database will reconcile all movement and resolve discrepancies
- The Device to Animal ID Cross Reference Database is used to link Devices to the actual Universal Animal Identification number (UAIN)
- Reference BIE white paper dealing with Centralized "Push" or JIT Decentralized "Pull"

Figure 21.1 illustrates this concept below.

Figure 21.1 Central Database for Chain of Custody



Distributed Database Concept for Chain of Custody

Assumptions:

- Only the Universal Animal Identification Number (UAIN) and the address reference of the Data Trustee that stores the information about the animal will be on the National database
- There will be multiple Data Trustee and Service Providers which submit data to the trusted collectors
- Data is not shared between different trusted collectors unless agreements are instituted
- Technical capabilities need to be provided to allow for service providers for a single Date Trustee (i.e. BIE) to access all information for a given individual animal under the guidance of agreed to specifications
- Data Trustees will have access to query the national database for an event activity on a specific Universal Animal Identification Number (UAIN) to reconcile an in transit movement.
- Move transactions may use the trailer license plate number in the remarks section to assist in the reconciliation process
- Reference BIE white paper dealing with Centralized "Push" or JIT Decentralized "Pull"
- SP/DT will reference the Device to Universal Animal Identification Number (UAIN) Cross Reference database as required

Sequence of Events for following diagram:

1 – Move out1 transaction of animals from Premises A to Premises B to SP/DT1

2 – Write in transit records to Suspense File

3 – Send UAIN and SP/DT address to National Database, if not previously transmitted to indicate UAIN data stored at the specific DT address

4 – Move in1 transaction of animals from Premises B to SP/DT1

5 – Remove in transit records from Suspense File

6 – Move out2 transaction of animals from Premises C to Premises D to SP/DT1

7 – Write in transit records to Suspense File

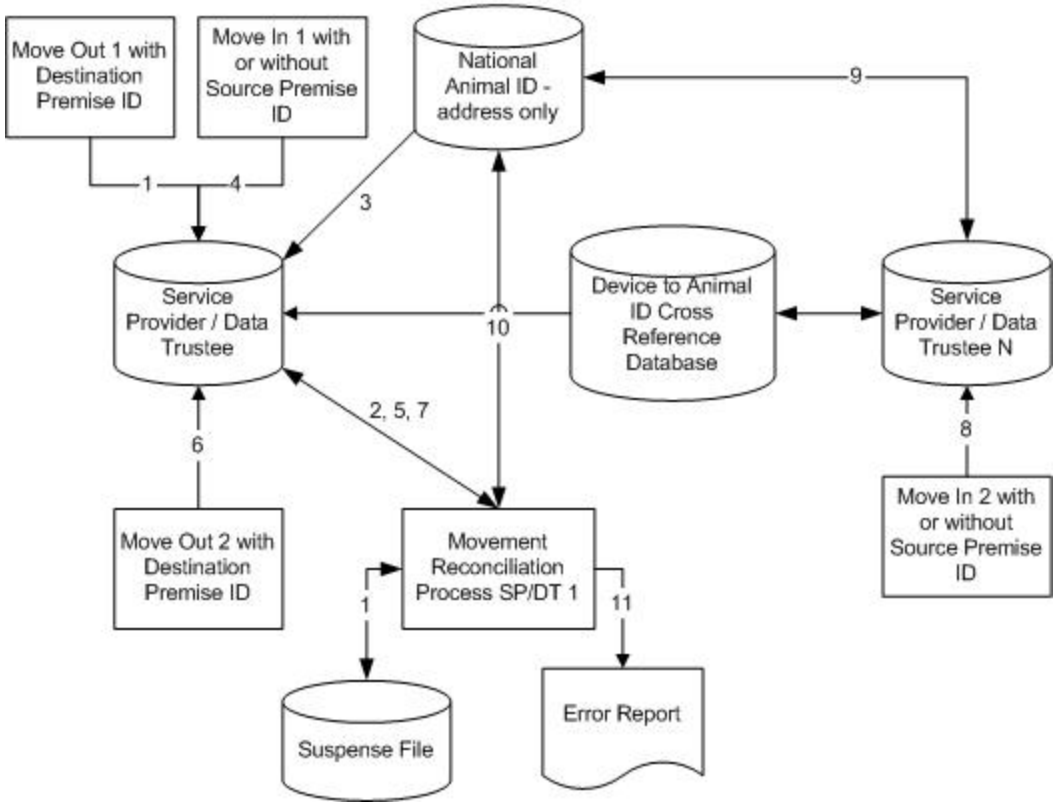
8 – Move in2 transaction of animals from Premises D to SP/DT2

9 – Send UAIN and SP/TC address to National Database

10 – SP/DT1 polls National Database for a corresponding timestamp to remove in transit records from Suspense File

11 – Any discrepancies on need to be reported and reconciled to ensure data integrity

Figure 21.2 Distributed Database for Chain of Custody



Conclusion

It is recommended that an automated movement transaction reconciliation process, Chain Of Custody, be established and incorporated into the USAIP to ensure the database information is synchronized with the actual movements of animals and the validation of the current premises location is achieved.